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COST REALISM HANDBOOK

FOR ASSURING MORE REALISTIC CONTRACTOR COST PROPOSALS

A HANDBOOK FOR
PROGRAM MANAGEMENT
AND SOURCE SELECTION
PERSONNEL

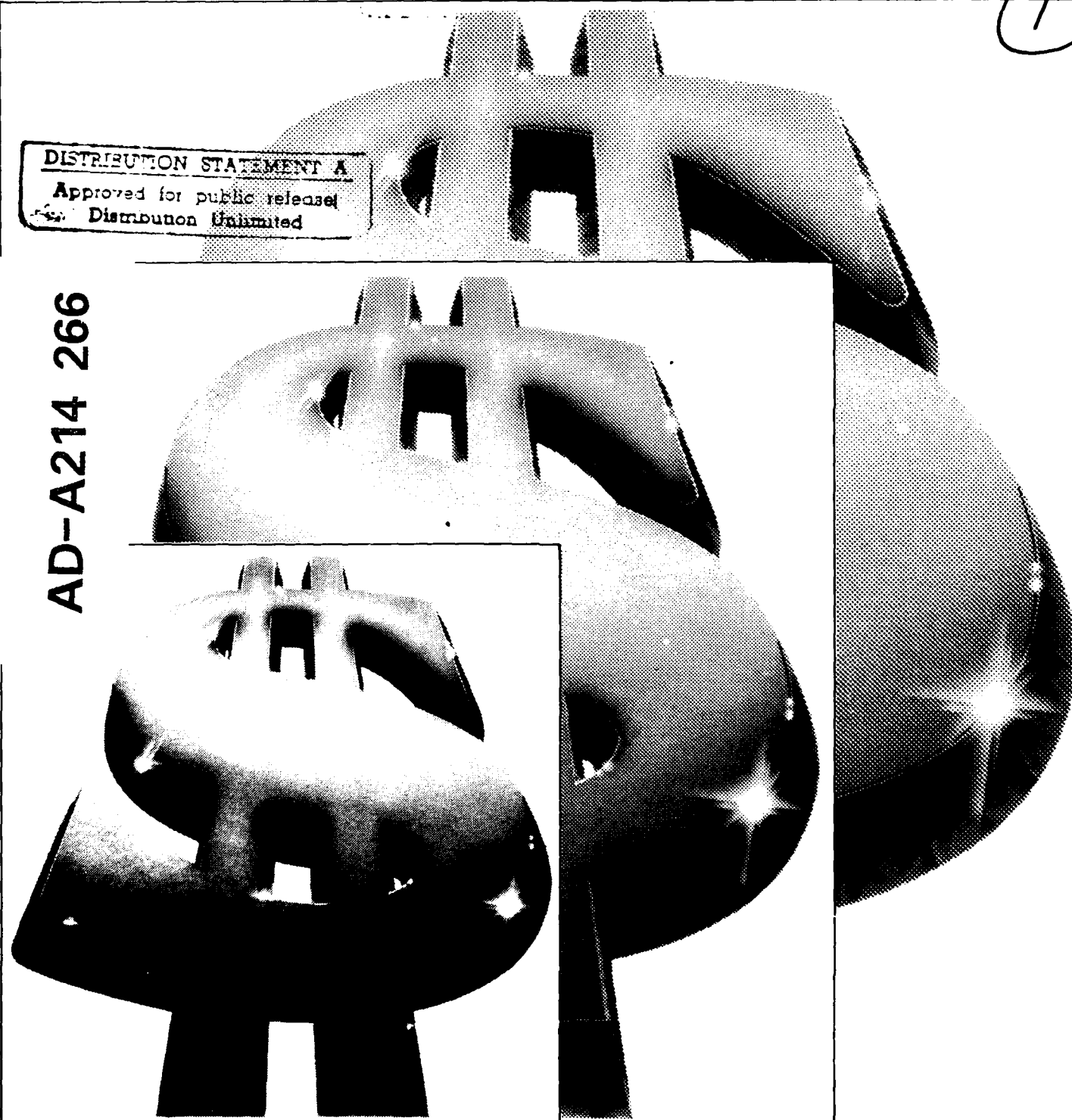
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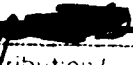


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**NAVY OFFICE FOR ACQUISITION RESEARCH
Washington, D.C. 20360**

PREFACE

This Handbook is about source selection cost evaluation for competitive, cost reimbursable contracts with particular emphasis on assuring more realistic contractor cost proposals. It is intended as a practical guide and reference for program management personnel and source selection personnel. It presents available techniques and procedures and how to apply them. The techniques are both qualitative and quantitative in nature.

Some readers may prefer to read only the summary information to obtain an overview on the subject, whereas others may want to read in detail so as to be able to apply the techniques.

This Handbook was developed and authored by Science Applications International Corporation, Arlington, Virginia, under contract number N00014-83-C-0123 directed by the Navy Office of Acquisition Research. The principal author is Donald Trapp who was supported by James Rydzewski and David Jordan.

Special thanks are due to the many Defense Department personnel who provided information for this Handbook and who reviewed the work at various stages. In particular, this Handbook has benefited greatly from the assistance and advice of Irwin Neveleff of the Naval Electronic Systems Command who has applied cost realism as a cost proposal evaluation technique for the past ten years.

The Navy Office of Acquisition Research is the controlling agency for this Handbook. Comments and recommendations relating to the Handbook are solicited. Based on your responses, revisions to the Handbook may be published.

Navy Office of Acquisition Research

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EXECUTIVE SUMMARY

This Cost Realism Handbook provides the Defense acquisition community with a methodology for evaluating contractor cost proposals, with particular emphasis on assuring more realistic cost proposals. This should be of particular interest to source selection cost evaluation teams, as well as to contracting officers and program managers. The methodology is applicable mainly to competitive, cost reimbursable contracts. The Handbook explains the various steps of the methodology in detail, provides an illustrative example, and describes computer models which may be useful in establishing scoring rules and evaluation factor weights.

The methodology includes four interrelated steps:

- (1) Evaluation Factors: Determination of cost evaluation factors;
- (2) Solicitation: Preparation of instructions to be included in the solicitation concerning the cost evaluation factors;
- (3) Government Estimate: Preparation of a Government estimated cost for each contractor; and
- (4) Evaluation: Rating or scoring each contractor for Government estimated cost and cost realism.

The methodology involves the best techniques and procedures currently being used in source selection cost evaluation. In addition this Handbook introduces several improvements to the current techniques, especially in the area of numerical scoring.

It is believed that application of this methodology will encourage contractors to make more realistic offers since they will be on notice, through the solicitation, that cost realism will be examined and could be a deciding factor in the award. The contractors will know that the evaluation procedures will reduce the likelihood of awards to low offers on cost reimburs-

able contracts unless realistically low, if cost is the deciding factor.

There are many factors involved in a source selection and each procurement is unique. Therefore, the cost evaluation methodology must be practical and flexible. Also, the results of applying the methodology must be logical. The methodology described in this Handbook will accomplish these objectives if it is used as a general guide and applied as appropriate to each procurement.

For a quick overview of the Handbook read the INTRODUCTION (Section I), the METHODOLOGY SUMMARY (Section IV) and the ILLUSTRATIVE EXAMPLE (Section X).

For a more detailed understanding of the methodology, read the separate sections on each of the four steps. Cost analysts who are involved or expect to be involved in a source selection should study the following sections in detail: EVALUATION (Section VIII) and SENSITIVITY AND TRADEOFF ANALYSIS (Section IX).

SECTION I

INTRODUCTION

Unrealism in Defense contractors' cost proposals, especially for RDT&E programs, often contributes to cost growth and related problems. Cost growth may require drastic changes in system design and program scope. It also may lead to schedule slippages and program cancellations. And, unrealistically high offers may lead to the Government paying too much. The Defense Department is therefore concerned with achieving greater cost realism.

This Cost Realism Handbook provides the Defense acquisition community with a methodology--that is techniques and procedures --for evaluating contractor cost proposals, with particular emphasis on assuring more realistic cost proposals. This should be of particular interest to source selection cost evaluation teams, as well as to contracting officers and program managers. The methodology is applicable mainly to competitive, cost reimbursable contracts. The Handbook explains the various steps of the methodology in detail, provides an illustrative example, and describes computer models which may be useful in establishing scoring rules and evaluation factor weights.

A. BACKGROUND

How realistic are contractor cost proposals? This is not easy to determine. The complexity and risks inherent in Defense systems make contractor cost estimation, not to mention Government review and evaluation of the costs, difficult. Some optimism may be warranted (e.g., in engineering hours required, in number of test articles, and in number of tests), but when does optimism become unrealism? In some cases, the contractor may purposely propose an unrealistically low cost in order to "buy-in" and thereby improve its business base and cash flow.

Data have been collected on proposed costs and Government estimates for eight programs from the Naval Electronic Systems Command (NAVELEX) which provide some insight into the degree of

realism found in contractor cost proposals for electronic systems. In developing its estimates, NAVELEX evaluated the contractor cost proposals in detail, required the contractors to justify their data and estimating rationale, developed their own estimates based almost entirely on the contractor's data, and compared these estimates with the cost proposals. The data showed that one out of three original offers was more than 20 percent low, and one out of six best-and-final offers was more than 20 percent low. Offers more than 20 percent below the NAVELEX estimate certainly raise a question as to cost realism. Interestingly, less than one-quarter of the original offers but nearly half of the best-and-final offers were within 3 percent of the NAVELEX estimates, apparently as a result of the detailed Government cost evaluation and the fact that cost realism was an evaluation criterion.

Of course, the Government must also guard against unrealistically high cost estimates. This situation will most probably occur if there are few technically qualified contractors and if a contractor already has an especially good business base. High cost estimates do minimize the likelihood of an overrun but the Government could probably have bought the system for less.

How do we achieve greater cost realism? This poses another difficult question, especially since there are often disincentives to realistic cost proposals in source selections for cost-reimbursable contracts. These disincentives occur because cost is generally a secondary consideration, especially for RDT&E contracts. Additionally, the Government often tends to award to the contractor with the lowest cost proposal, if technical and other factors are not too different; or at least, the contractors may perceive that the Government has such a bias.

The Defense Department needs to continue to develop and refine acquisition policies and practices which encourage and achieve more cost realism. In particular, source selection procedures should be improved so as to do more to:

- Encourage realistic bids,
- Discourage awards to the low bidder on RDT&E contracts unless realistically low, if cost is the deciding factor, and
- Discourage success orientation bias.

It is primarily through the source selection cost evaluation process that the Government can direct efforts to give greater assurance that cost proposals are reasonable, defensible and realistic.* In a general sense, then, cost realism may be defined as that part of the source selection process directed at giving greater assurance of the reasonableness and defensibility of contractors' cost proposals.

B. METHODOLOGY

A source selection cost evaluation methodology is described in this Handbook which should assure a sound cost evaluation and should encourage contractors to make more realistic offers. This methodology includes four interrelated steps:

- (1) Evaluation Factors: Determination of cost evaluation factors;
- (2) Solicitation: Preparation of instructions to be included in the solicitation concerning the cost evaluation factors;
- (3) Government Estimate: Preparation of a Government estimated cost for each contractor; and
- (4) Evaluation: Rating or scoring each contractor for Government estimated cost and cost realism.

The methodology involves the best techniques and procedures currently being used in source selection cost evaluation,

* Acquisition policies and practices other than those associated with source selection cost evaluation may also help in assuring more realistic cost proposals (e.g., certain incentive type contracts and the application of risk analysis in the proposal preparation). These other policies and practices are discussed briefly in Section XI.

especial'y, those of NAVELEX. In addition, this Handbook introduces several improvements to the current techniques.

NOTE: The terms "Government estimated cost" and "Government estimate" are used in this Handbook for the Government estimate of the likely cost for each contractor.

A definition of cost realism was given above. The methodology suggests a more specific definition of cost realism as an evaluation criterion stated in the solicitation which compares the contractor's proposed cost with a detailed Government estimate for each contractor and then rates or scores the degree of realism.

It is believed that application of this methodology will encourage contractors to make more realistic offers since they will be on notice, though the solicitation, that cost realism will be examined and could be a deciding factor in the award. The contractors will know that the evaluation procedures will reduce the likelihood of awards to low offers on cost reimbursable contracts unless realistically low, if cost is the deciding factor.

There are many factors involved in a source selection and each procurement is unique. Therefore, the cost evaluation methodology must be practical and flexible. Also, the results of applying the methodology must be logical. The methodology described in this Handbook will accomplish these objectives if it is used as a general guide and applied appropriately to each procurement.

The next section of the Handbook provides background on the source selection process. The third section discusses cost realism and cost growth. Next, the methodology is summarized. This is followed by four sections which discuss each of the main components of the methodology: evaluation factors, solicitation, Government estimate, and evaluation. Then, sensitivity and tradeoff analyses are discussed. An illustrative example is provided in Section X. Several methods for assuring greater

cost realism, other than those involving source selection cost evaluation, are then discussed. Conclusions are presented in a final section. There are five appendicies which provide definitions of key terms, a listing of acronyms and symbols, policy document excerpts, a cost-benefit analysis, and a complete description of the cost realism computer models including sample outputs.

SECTION II

SOURCE SELECTION

This section provides some background on Government procurement policies and discusses the source selection process. Then, cost considerations in source selection are discussed.

A. BACKGROUND

A procurement process has evolved in the Department of Defense (DOD) for acquiring necessary supplies and services of the desired quality in a timely manner, and at fair and reasonable prices. This procurement process involves certain procedures for translating requirements into contracts. The overall objective of this process is to obtain the best value, given cost, technical and other considerations. There are two major methods of procurement--"formal advertising" and "negotiation".

Formal advertising is the preferred method where competition is present, the supplies or services can be adequately and precisely specified, and the selection can be made solely on price. The Government issues an invitation for bids (IFB), contractors respond with price bids, and the Government awards the contract to the lowest bidder. Bid prices do not have to be substantiated by the bidders. The Government does not analyze the costs, and the costs are not subject to negotiation.

Procurement by negotiation is used when it is impractical to secure competition by formal advertising, when the products being procured are new and complex, and under certain other circumstances as specified in the Federal Acquisition Regulations (FAR). It is especially appropriate for RDT&E programs. In procurement by negotiation, the Government issues a solicitation, either a request for proposals (RFP) or a request for quotations (RFQ); contractors* respond with technical and cost

* A contractor who submits a proposal or offer to the Government in response to a Government solicitation is often referred to as an "offeror". The terms contractor and offeror are often used interchangeably in this Handbook.

proposals (often very detailed); and discussions and negotiations (often extensive) are conducted between the Government and the contractors involving all aspects of the proposals (e.g., technical, cost and schedule). The Government then awards the contract primarily on the basis of a contractor's ability to perform the work, as demonstrated by its proposal. The Government requires that the contractor cost proposals be substantiated with detailed data and a discussion of the estimating methodology. The Government analyzes these costs and negotiates them with the contractors.

B. SOURCE SELECTION PROCESS

The source selection process applies to negotiated procurements where contract award will be based on factors in addition to price. In order to arrive at a best possible award decision, a common source selection organization and set of procedures have evolved among the Services. These policies and procedures have been developed primarily for major procurements, as defined by DOD Directive 5000.1, Major Systems Acquisitions (e.g., RDT&E exceeding \$200 million in FY80 dollars). However, less-than-major procurements often follow many of the same policies and procedures. It should be noted that there is a certain amount of flexibility in the source selection organization and procedures (e.g., in the size and composition of the source selection team and in the evaluation methods used).

The source selection organization typically comprises the elements shown below:

- Source Selection Authority (SSA)
- Source Selection Advisory Council (SSAC)
- Source Selection Evaluation Board (SSEB)
- Procurement Contracting Officer (PCO)
- Project/Program Manager (PM)

The source selection organization executes a series of steps that culminates in an award decision. These steps are listed below:

Source Selection Plan Preparation and Approval
Solicitation Preparation and Approval
Proposal Evaluation
Competitive Range Determinations
Discussions/Negotiations
Best and Final Proposal Evaluation
Source Selection and Award

C. COST CONSIDERATIONS IN SOURCE SELECTION

Prior to beginning source selection, cost is important for planning, programming and budgeting. During this time, there is limited project definition, but a cost estimate for a notional system is necessary for planning and early budgeting. And, of course, cost is an important consideration throughout the source selection process, from preparation of the Source Selection Plan to award. Generally, there is an extensive effort to assure that the best value is identified and that the costs are reasonable and realistic, so as to reduce the possibility of either large overruns or accepting too high an offer. However, cost is only one evaluation factor in source selections and is usually not the driving factor for RDT&E programs.

Some of the steps in the procurement process leading to the selection of a source where cost is important are discussed below:

Early Project Definition. Preceding a decision to procure a system is the need to provide technical definition of the item and from that to provide preliminary cost estimates for use in planning and budgeting. These cost estimates are typically based on gross information and top-level cost estimating techniques (e.g., parametric) and require later refinement as better project definition occurs. These early cost estimates represent the Government estimate and best judgment as to probable cost. These early estimates may affect the Government assessment of the reasonableness of offerors' costs. They may also affect the offerors' cost proposals since the budget may be known to them.

Source Selection Plan Preparation. In preparing the Source Selection Plan, the cost evaluation criteria, the weights to be given the various cost criteria, and

the method of ranking or scoring proposals must be determined.

Solicitation Preparation. The solicitation formalizes the groundrules for the offerors' cost submission. While there is a significant body of existing policy which gives the Government leverage in pursuing cost questions (e.g., data, traceability, estimation methodology), a well thought through and prepared solicitation can facilitate the Government obtaining what it needs to prevent either cost overrun from a buy-in or paying too much. Also, the solicitation can create an atmosphere regarding the importance of costs that can influence the offerors' attitudes towards the reasonableness of costs in the proposal. Specification of a project work breakdown structure (WBS) for portraying cost estimates, and specifying that cost estimates must be auditable and defensible can help set a proper atmosphere.

Proposal Price/Cost Analysis* Upon receipt of offerors' cost proposals (original, revisions, or best-and-final), analysis is undertaken to validate the reasonableness, accuracy, and currency of the submissions. The cost proposal review is integrated with the technical review to assure the offerors' cost estimates reflect the offerors' technical plans.** A variety of analysis techniques are called upon in the source selection process. The Federal Acquisition Regulations (FAR) provides for aggregate analyses (i.e., price analysis) or more detailed cost element review (i.e., cost analysis). Other cost review techniques are selectively used such as "Will Cost" and "Should Cost" reviews (which are a form of cost analysis) in order to test the defensibility of the offerors' price/cost proposals.

Proposal Evaluation. There is a need to arrive at a judgment of the quality and reasonableness of the offerors' cost proposals. And, some method is necessary to communicate this judgment to the SSA. This is generally done by ranking the offerors through the assignment of numerical values or adjective assessments (e.g., good, fair). Whether or not such a ranking is done, narrative descriptions of the analysis results are usually presented to the SSA.

Source Selection and Award. Based on assessments of technical, cost, management and other factors, the SSA

* See Appendix A for definitions of price and cost analysis.

** Technical proposal evaluators are restricted from seeing the overall cost proposals.

will decide which source will provide the best value to the Government and make a contract award.

SECTION III COST REALISM

This section first suggests definitions for the term "cost realism". Then, the problem of cost growth is discussed, and the degree of realism observed in cost proposals is analyzed. Also, the extent to which cost realism is reflected in Government policy is discussed.

A. COST REALISM DEFINED

It is in the source selection steps discussed in the previous Section that the Government can direct efforts to give greater assurance that cost proposals are reasonable, defensible and realistic. In a general sense, then, cost realism may be defined as that part of the source selection process directed at giving greater assurance of the reasonableness and defensibility of contractors' cost proposals. Synonyms for realism are reasonableness, defensibility, credibility, and validity.

The term cost realism has also developed a more specific meaning in organizations like NAVELEX and NAVAIR. They have included cost realism as an explicit evaluation criterion in the solicitation, have prepared detailed Government cost estimates which are compared to the contractors' proposals, and have evaluated and rated cost realism along with estimated cost, technical and other factors. Thus, a more specific definition of cost realism is an evaluation criterion stated in the solicitation which compares the contractor's proposed cost with a detailed Government estimate for each contractor and then rates or scores the degree of realism.

As used throughout this Handbook, the term cost realism will generally be used only in the second, more specific sense where cost realism has been made an explicit evaluation criterion in the source selection process.

B. COST GROWTH

As mentioned in the Introduction, unrealism in Defense contractors' cost proposals, especially for RDT&E programs, often contributes to cost growth and related problems.

In the past, many Defense acquisition programs have shown tremendous cost growth between their inception and fielding. Attempts to understand and cope with cost growth date back at least to 1962, when Peck and Scherer published one of the first, important studies of the problem.* Many studies have followed. Congress has expressed great interest in the subject of cost growth and, in November 1981, took the unprecedented step of requiring that Service Secretaries prepare a detailed report to Congress if cost growth on a major program exceeds 15% or face suspension of further obligations. If cost growth exceeds 25%, the Secretary of Defense must certify to Congress that the program is essential and that the new cost estimates are reasonable.**

Of course, cost growth can occur for many reasons--some of them beyond the control of the offerors and the Government. These reasons include the many risks and uncertainties associated with technically advanced and complex Defense systems. Program redirections, scope changes and quantity changes also cause cost growth (or may be caused by cost growth). Some causes, such as inflationary forces, are outside the Defense Department's control.

Cost growth may also be due to an award to an offeror with an unrealistically low offer. Such unrealistic offers, especially for RDT&E, may be due to overly optimistic projections and competitive pressures. This is often referred to as the "buy-in" problem.

When an offeror who is unrealistically low wins a procurement, the likelihood of a cost overrun is significantly increased

* Merton J. Peck and Frederic Scherer, The Weapons Acquisition Process: An Economic Analysis, Harvard University Press, 1962.

** The Vunn-McCurdy Amendment to the 1983 DOD Authorization Act.

and probably inevitable. For example, if the Government awards a contract to an offeror whose offer is 20% less than what appears realistic, there is a good likelihood that there will be cost growth of at least 25 percent (20/80)--so due to this lack of cost realism alone we are likely to reach the Nunn-McCurdy 25 percent Amendment "threshold".

Cost growth means more than higher costs; it may lead to schedule slips, to program cancellation, and even to the cancellation of other programs in order to provide the required additional funds. Cost growth may also require drastic changes in system design and program scope. Furthermore, frequent cost overruns undermine and eventually destroy public confidence in the Government's capability to manage its programs.

C. COST REALISM ANALYSIS

As mentioned in the Introduction, data have been collected on proposed costs and Government estimates for eight programs from the Naval Electronic Systems Command (NAVELEX). This data provides some insight into the degree of realism found in contractor cost proposals. In developing its estimates, NAVELEX evaluated the contractor cost proposals in detail, required the contractors to justify their data and estimating rationale, developed their own estimates based almost entirely on the contractor's data, and compared these estimates with the cost proposals. The data showed the following:

	Original Offers (23 offers)	Best & Final Offers (19 offers)
More than 20% low	30%	16%
Within 3%	22%	47%

One out of three original offers was more than 20 percent low, and one out of six best-and-final offers (BAFOs) was more than 20 percent low. Offers more than 20 percent below the NAVELEX estimate certainly raise a question as to cost realism.

Interestingly, less than one-quarter of the original offers but nearly half of the BAFOs were within 3 percent of the NAVELEX estimates, apparently as a result of the detailed Government cost evaluation and the fact that cost realism was an evaluation criterion.

The degree of realism for each of the offerors is shown in Figure 3.1. Most of the offers are lower than the Government estimate. The BAFOs are noticeably more realistic. Both the offers and the BAFOs are in ascending order of realism. The BAFO corresponding to each original offer is shown in Figure 3.2. While it is often assumed that most BAFOs will be lower than the original offers, for these NAVELEX programs, 11 of the 18 BAFOs were higher. This is shown in Figure 3.3.

D. COST REALISM AS REFLECTED IN GOVERNMENT POLICY

The Federal Acquisition Regulations (FAR), formerly the Defense Acquisition Regulations (DAR), is the primary DOD document establishing procurement policy. While the FAR does not specifically mention "cost realism", it does refer to the reasonableness of costs in a number of places. It states that "fair and reasonable prices" are to be negotiated, that "Government procurement is concerned...with the reasonableness of the price which the Government ultimately pays" and that "What is reasonable depends on a variety of considerations and circumstances." The FAR also states that "Proposals for cost reimbursable type or fixed price contracts may be penalized during evaluation to the degree that the estimated cost is unrealistically low."

DOD issued a Directive in 1976 concerning source selection (Directive 4105.62) which like the FAR does not specifically mention "cost realism".* The Directive does refer to the reasonableness and credibility of costs. It states that proposals should "permit verification of their cost credibility".

* Except that in reference to discussions with the contractors prior to selection, the Directive states: "The discussion of the cost/price proposals may include...cost realism of the offeror's proposal...."

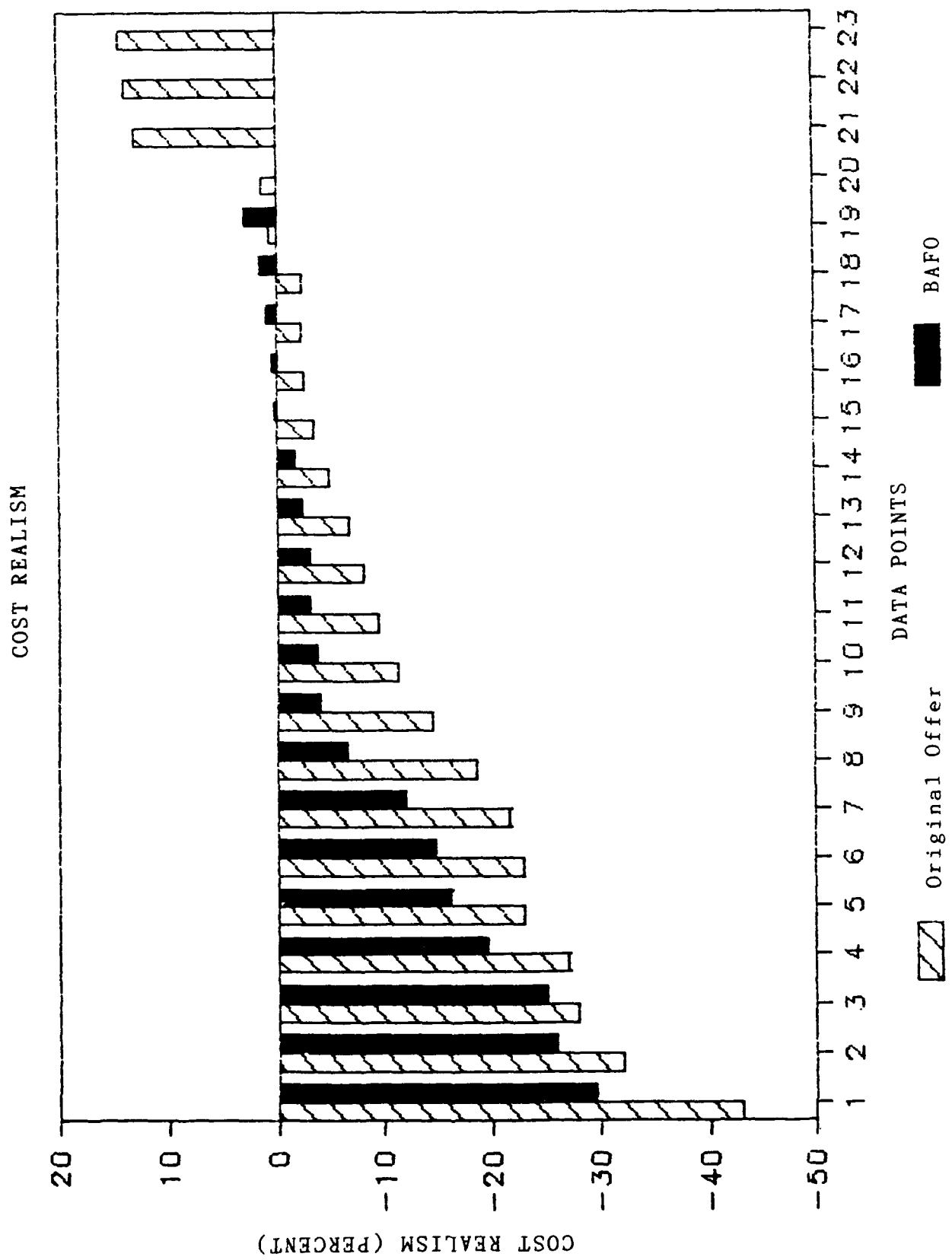


Figure 3.1 Cost Realism Analysis I

COST REALISM
Original Compared to BAFO

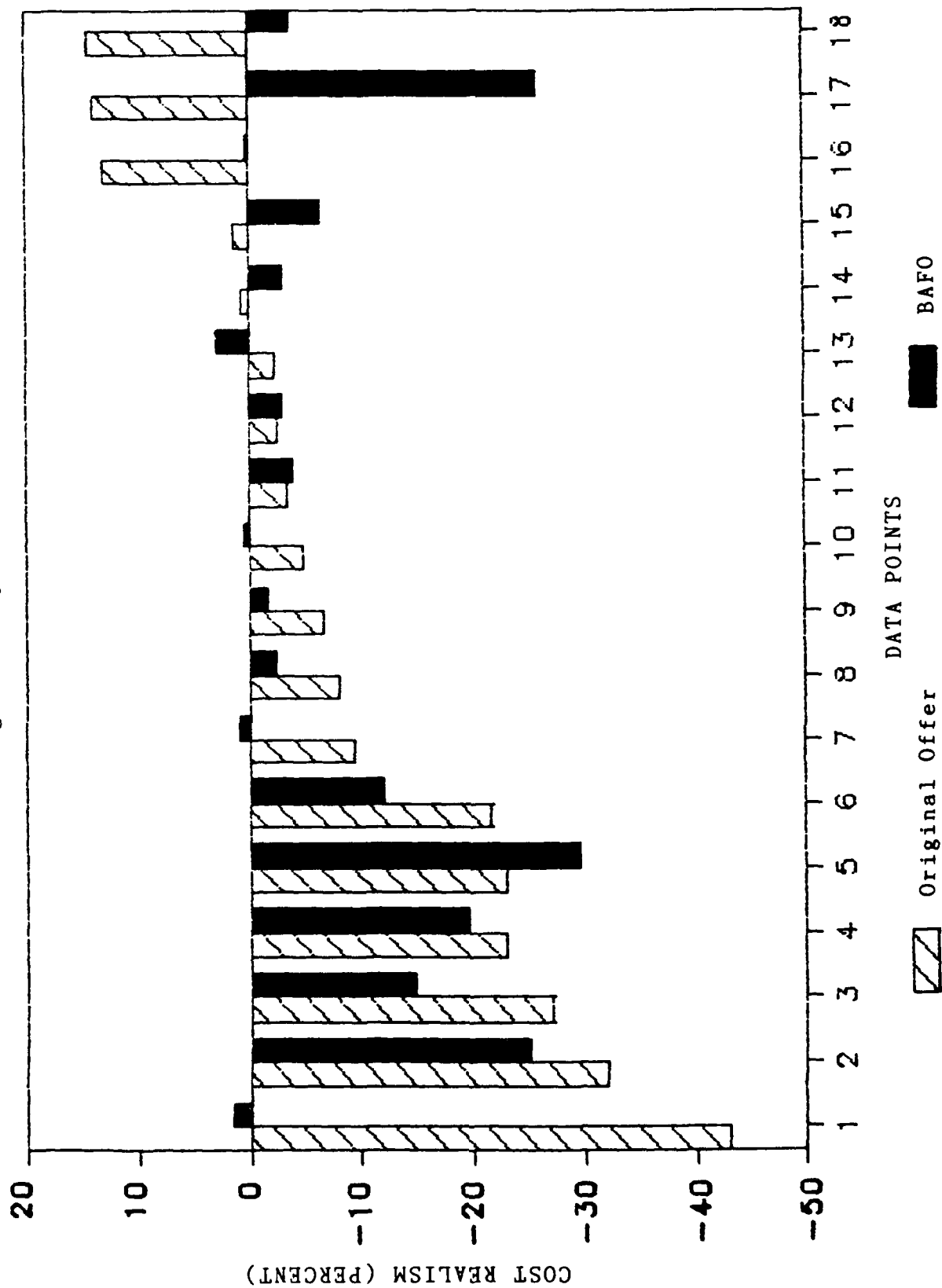


Figure 3.2 Cost Realism Analysis II

COST REALISM

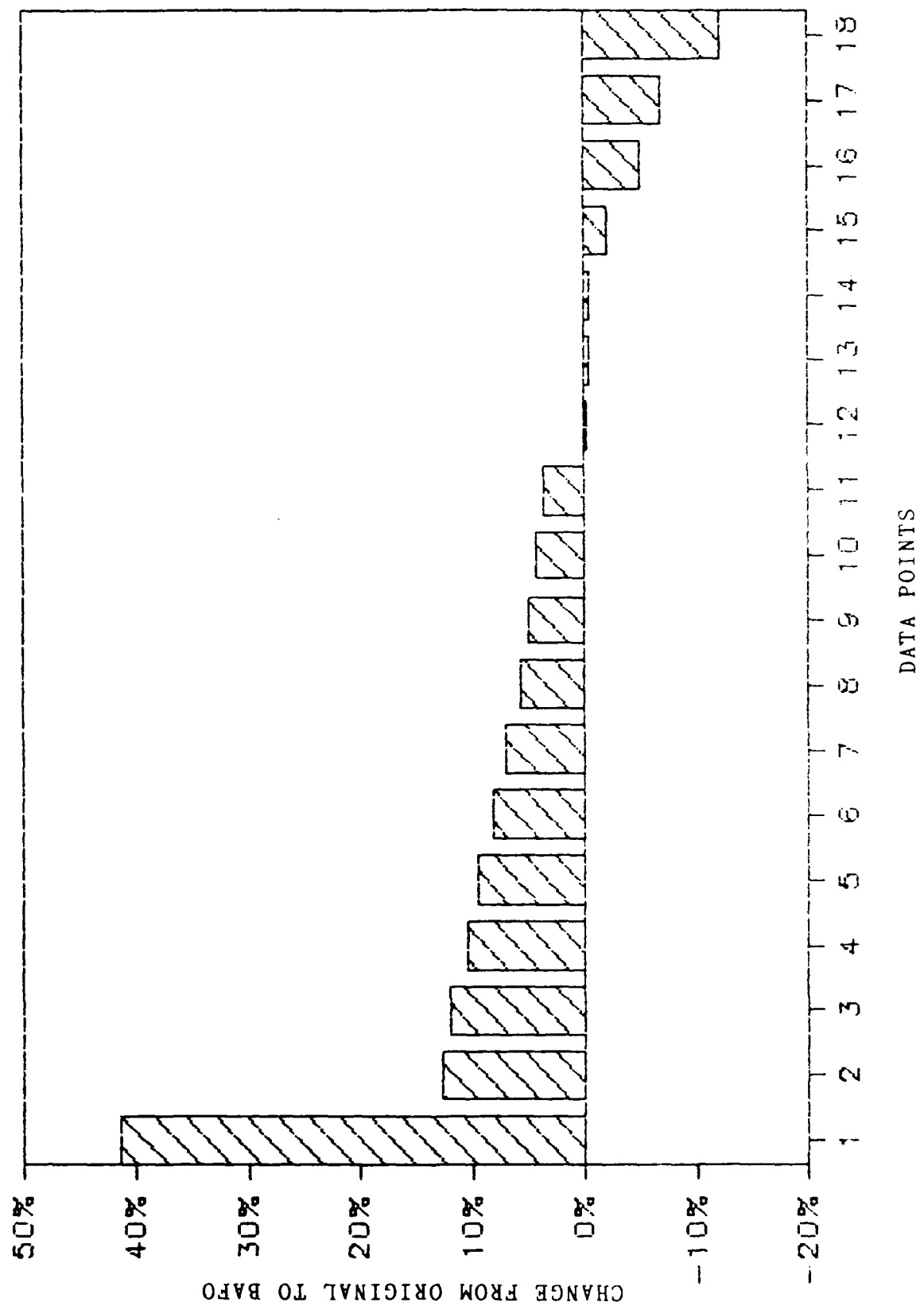


Figure 3.3 Cost Realism Analysis III

It also states that "any apparent inconsistency between promised performance and cost or price should be explained...any significant inconsistency, if unexplained raises a fundamental issue of the competitor's understanding of the work required...and may be grounds for rejection of the proposal...burden of proof of cost credibility rests with the offeror". Further, the Directive states that "The primary goal of evaluation is to determine, for each competitor, the most likely outcome in terms of system characteristics, costs (development, production and support), and schedules".

A recent draft revision of DOD Directive 4105.62 states that "Independent cost estimates are necessary as a bench-mark against which to compare proposed cost estimates... The realism of the offeror's proposed proposal should be indicated by a ranking relative to the Government's estimate."

The Government Accounting Office issues decisions related to source selection award protests. These decisions are a form of Government policy. In one decision, the following statement was made regarding cost realism: "A low [offer] should not be accepted at face value... An agency should make an independent cost projection...to ensure that costs are examined in terms of their realism...under a cost-reimbursement type contract...[GAO 81-2 CPD 178]".

None of the Navy acquisition policy documents examined (NAVMAT 4200.49, NAVELEX 4200.12C, and NAVAIR 4200.24 and .27) specifically mention "cost realism". However, the documents make some references to reasonableness and credibility of costs. For example, NAVMAT Instruction 4200.49 requires the Contracting Officer to "assure that proposals are requested on a basis which permits verification of their cost credibility."

Both Army and Air Force acquisition policy documents refer to "cost realism" in some detail. The Army Materiel Command (now DARCOM) issued Regulation 715-1 in 1970 which is entitled "Cost Realism in Proposal Evaluations." This Regulation provides the following definition: "Cost realism is defined as the employment of preplanned methods to determine the probable

total cost for a procurement at completion; cost realism involves a comprehensive analysis to develop and establish the probable overall cost of performance when related to the required technical scope of the work." The purpose of the Regulation is "to stress cost realism procedures as a method used to reduce cost growth and inaccurate cost estimating on the part of both the Government and the potential contractors." Cost realism is to be used "in all procurements [involving] multiple evaluation factors...."

The Department of Air Force issued Regulation 70-15 in 1976 concerning source selection which states that: "Continued effort must be exerted to achieve greater cost realism in proposals for major development programs." It also states that "a proposal may be penalized...to the degree that the proposed cost/price is unrealistically low."

A number of excerpts related to source selection cost evaluation taken from the above policy documents are provided in Appendix C.

The policy documents cited above provide broad guidance in the area of cost evaluation to Government personnel conducting source selections. The importance of assessing the reasonableness, credibility, validity, and realism of costs is stressed. While the term cost realism does not appear in all of the policy documents, the other terms used have approximately the same meaning. The policy documents are not very specific about how to assess cost realism or how to encourage offerors to be more realistic in their cost proposals.

SECTION IV

METHODOLOGY SUMMARY

The source selection cost evaluation methodology described in this Handbook should assure a sound cost evaluation and should encourage contractors to make more realistic offers. This methodology includes four interrelated steps:

- (1) Evaluation Factors: Determination of cost evaluation factors;
- (2) Solicitation: Preparation of instructions to be included in the solicitation concerning the cost evaluation factors;
- (3) Government Estimate: Preparation of a Government estimated cost for each contractor; and
- (4) Evaluation: Rating or scoring each contractor for Government estimated cost and cost realism.

The methodology involves the best techniques and procedures currently being used in source selection cost evaluation. In addition, this Handbook introduces several improvements to the current techniques--most importantly techniques for numerical scoring tradeoff analyses.

NOTE: The terms "Government estimated cost" and "Government estimate" are used in this Handbook for the Government estimate of the likely cost for each contractor.

The methodology associated with each of the above steps is summarized below and discussed in detail in the next four sections:

Evaluation Factors: Make cost realism as well as Government estimated cost explicit cost evaluation sub-criteria. Assess cost realism based on the difference between the contractor offer and the

Government estimate. Assess Government estimated cost based on the likely cost to the Government for each contractor. Make Design-to-Unit-Production Cost (DTUPC) and Life Cycle Cost (LCC) sub-criteria only if credible estimates can be developed. Even then, generally weight DTUPC and LCC low relative to Government estimated cost and cost realism.

Solicitation: Specify cost realism in addition to Government estimated cost as cost evaluation sub-criteria in the solicitation and specify the Work Breakdown Structure (WBS) to be used and the type of backup data required. The WBS should be tailored to each procurement but conform as much as practical to WBSs for similar types of systems and programs.

Government Estimate: Develop a Government estimate for each offeror based on a detailed evaluation of that offeror's proposal, including fact-finding as appropriate. The offerors should be required to justify the data and techniques used in developing their cost proposals. If time and resources permit, estimates based on parametric and analogy techniques should also be made as a cross-check.

Evaluation: Rate or score Government estimated cost and cost realism for each contractor. If qualitative rating is used, apply a rating or grade (e.g., an adjective) for each cost evaluation sub-criteria. If numerical scoring is used, apply a triangle, a trapezoid or normal curve scoring rule. The Government estimated cost score is a function of the difference between the Government estimate for each offeror and the lowest Government estimate for any offeror. The cost realism score is a function of the difference

between the offer and the Government estimate. The differences corresponding to a minimum score (triangle or trapezoid) or to a 95 percent likelihood (normal curve) should be determined for each procurement based on sensitivity and tradeoff analyses. Also prepare a tabular, and possibly graphical, presentation of the a) offers, b) Government estimates, c) percent differences between the Government estimates and the lowest Government estimate, and d) percent differences between the offers and the Government estimates. In addition, prepare a narrative cost evaluation.

It is believed that application of this methodology will encourage contractors to make more realistic offers since they will be on notice, through the solicitation, that cost realism will be examined and could be a deciding factor in the award. The contractors will know that the evaluation procedures will reduce the likelihood of awards to low offers on cost reimbursable contracts unless realistically low and cost is the deciding factor.

There are many factors involved in a source selection and each procurement is unique. Therefore, there needs to be flexibility in the cost evaluation in order to take into account such factors as the technical and program risks, the stage of development, the nature of the hardware, the size of the procurement, the time to conduct the evaluation, the resources available for the evaluation, and the experience of the source selection team. The methodology described in this Handbook should be used as a general guide and applied as appropriate to each procurement.

The next four sections discuss each of the above steps in detail. An illustrative example of how to apply the methodology is provided in Section X.

SECTION V

EVALUATION FACTORS

Generally, the two most important source selection factors or criteria are technical and cost. In RDT&E competitions, technical is usually far more important than cost. Additional evaluation criteria may include management, supportability, and schedule. Each evaluation criterion may have several sub-criteria.

In evaluating cost, the most important factors are the likely cost to the Government for each offeror and the realism or reasonableness of the offers. The former will be termed the Government estimated cost sub-criterion and the latter the cost realism sub-criterion. Both sub-criteria are important because, from the cost perspective, the award of a contract should be made not just on the basis of a low cost, but a realistically low cost if cost is the deciding factor. However, Government estimated cost will generally be weighted significantly higher than cost realism, in order to avoid trading cost realism for an unreasonably high price (this is discussed in Section IX, Sensitivity and Tradeoff Analyses). Other cost sub-criteria might include Design-to-Unit Production Cost (DTUPC) and/or Life Cycle Cost (LCC).

It should be noted that the Government estimated cost for a contractor and not the contractor's offer should be the primary cost evaluation criterion. This should help to assure that offers will be realistic--the offeror would have little reason not to be realistic since the offer is used only in figuring the degree of cost realism. (Of course, the offeror might decide not to be realistic in certain areas which he figures will not be discovered during the Government's cost evaluation and fact-finding.)

In a sense, all cost evaluations will address the realism or reasonableness of contractors' offers. For example, cost evaluators will normally check for completeness, accuracy and reasonableness of the offers. However, if the contractors are

to be encouraged to make more realistic offers, it is very important to make cost realism an explicit evaluation sub-criterion even if a small weight is used. In this way the offerors will know that they will be penalized for an unrealistically low offer--a "buy-in" which would likely lead to built in cost growth--and penalized for an unrealistically high offer which would likely result in a greater cost to the Government than necessary.*

Government estimated cost can be assessed on the basis of the likely cost to the Government for each contractor. The lower the Government estimate, the better. This evaluation sub-criterion also requires that a realistic Government estimate be developed, as described in Section VII.

Cost realism can be assessed on the basis of the difference between the proposed cost (the offer) and a Government estimate of the realistic cost for that contractor. The smaller this difference, the more realistic the offer. Therefore, a realistic Government estimate for each contractor is of critical importance.

DTUPC and LCC may be important in some RDT&E competitions. For example, because of different designs and approaches by different contractors, there may be significant differences in DTUPC and LCC. And, procurement and operations savings may more than offset higher development costs. Nevertheless, DTUPC and LCC should generally be given relatively little weight compared to Government estimated cost and cost realism. This will assure that Government estimated cost and cost realism have sufficient weight in the overall source selection evaluation. Too many sub-criteria should be avoided because the effect of each gets "watered down" in terms of overall score. Furthermore, DTUPC and LCC may be difficult to estimate early in an RDT&E program,

* Under a cost reimbursable contract, the contractor is paid only for costs incurred plus a fee. But, if he is given an award for an amount substantially higher than the Government estimated cost (i.e., more than is realistic), then he will generally find ways to spend the extra money--if not consciously, then through less incentive to be efficient.

and there may be a considerable expense to contractors and the Government associated with evaluating DTUPC and LCC. Also, contractors are generally not held accountable for their DTUPC and LCC estimates.

Prior to issuing the solicitation, weights for each of the criteria and sub-criteria should be determined. For RDT&E programs, cost will usually be weighted much lower than technical. For example, cost might be 20 to 30 percent and technical 50 to 70 percent of the total score, with other criteria making up the difference. Deciding on the weighting of cost and the breakout between Government estimated cost and cost realism should be based on experience. If numerical scoring is to be used, an analysis can be made of the effects of different weights and scoring rules on the overall scores for hypothetical proposals. Such an analysis should consider the tradeoff between cost and technical scores (e.g., the degree of cost realism that would be traded for a certain degree of technical superiority). This is discussed further in Section IX, Sensitivity and Tradeoff Analyses.

Methodology: Make cost realism as well as Government estimated cost explicit cost evaluation sub-criteria. Assess cost realism based on the difference between the contractor offer and the Government estimate. Assess Government estimated cost based on the likely cost to the Government for each contractor. Make DTUPC and LCC sub-criteria only if credible estimates can be developed. Even then, generally weight DTUPC and LCC low relative to Government estimated cost and cost realism.

Making cost realism an explicit evaluation criterion has great merit. It places contractors on notice that cost realism will be examined and could be a deciding factor in the award. The Government source selection team is also on notice to address cost realism specifically. The actual evaluation of cost realism can be done at many levels of detail depending on

the procurement and the personnel available. Regardless of the level of detail, the key point is to make cost realism an evaluation factor which the contractors know can influence the award. Furthermore, a detailed cost evaluation, such as that required for assessing cost realism can help in negotiation and is likely to result in best-and-final offers which are more realistic than the original offer.

SECTION VI

SOLICITATION

A. GENERAL

The solicitation, in the form of an RFP or RFQ, is the formal document specifying the Government's requirements associated with an impending procurement, as well as such matters as the terms and conditions and evaluation criteria. It is important to inform the prospective offerors in the solicitation that, among other factors, they will be evaluated on the basis of cost realism and that an unrealistic offer may be grounds for rejecting the proposal. Knowing that they may be penalized for unrealistic offers will certainly encourage the offerors to be more realistic. Whether they will in fact be more realistic depends on how the offerors weigh the penalty for being unrealistic against other factors, such as a belief that the award will be biased toward the low offer despite any unrealism.

Since the cost proposals must be evaluated by the Government in some detail in order to determine whether they are realistic and complete, it is important that the solicitation specify a work breakdown structure (WBS) tailored to the procurement and specify the type of data required to backup the cost proposal. By specifying a WBS, consistency among offerors is increased and the WBS can be tailored to break out those areas in which cost visibility is desired, such as areas where risk is considered greatest. Thus, a well structured WBS can simplify the job of cost evaluation.

It is desirable that WBSs become more standardized and consistent for all programs so that improved cost data bases can be developed which will facilitate future cost estimating and cost evaluation. Achieving more standardized and consistent WBSs requires more commonality of WBS items at the higher levels of the WBS structure for all programs than is now the case. It also requires nearly identical WBSs except at the lowest levels of the WBS structure for similar types of systems and programs.

While Military Standard 881A has helped to standardize WBSs, it is somewhat general and allows a lot of latitude in structuring a WBS. The Office of the Secretary of Defense and the higher levels of the Services have the primary responsibility for achieving greater standardization and consistency of WBSs, but each source selection organization can help by conforming as much as practical to WBSs for similar types of systems and programs. Improved WBS formats would be particularly helpful in developing far more consistent and useful cost data bases from actual contract costs. Such improved data bases would facilitate not only future cost estimating but also contract monitoring.

By carefully specifying the type of cost proposal backup data, the job of cost evaluation can also be greatly simplified. Examples of some of the backup data that might be requested are: a list of material high dollar items; a list of all tools, test equipment and facilities; and monthly manloading charts by functional labor categories.

It should be noted that under Public Law 98-369, known as the Truth in Negotiations Act, contracting officers are required to obtain cost or pricing data from contractors for negotiated procurements exceeding \$100,000 (recently revised from the \$500,000 threshold in Public Law 87-653). In submitting such data, each contractor must certify that, to the best of his knowledge and belief, the data are accurate, complete, and current. The certification applies to the validity of factual data in the contractor's possession, and not to the efficacy of estimates or judgment factors. The contractor is only required to submit data that are "reasonably available" to him.

Therefore, the Government has a legal right to detailed cost and pricing data. Furthermore, DOD Directive 4105.62 states that the "burden of proof of cost credibility rests with the offeror."

Methodology: Specify cost realism in addition to Government estimated cost as cost evaluation sub-criteria in the solicitation and specify the WBS to be used and the type of backup data required. The WBS should be tailored to each procurement but conform as much as practical to WBSs for similar types of systems and programs.

Specific clauses that can be used in the solicitation are suggested below.

B. SPECIFIC CLAUSES

Various clauses should be included in the solicitation which clearly state the Government intentions regarding the evaluation of costs. Suggested clauses are provided below related to the cost evaluation in general, the cost evaluation criteria, and the cost proposal data required (including the WBS and back-up data). These clauses are based largely on clauses developed by NAVELEX. The cost evaluation team should tailor the exact wording of these clauses for each program. Placement of these clauses within the solicitation will depend upon the organization of the RFP. A key point is to explicitly inform the offerors that cost realism will be examined and could be a deciding factor in the award. The words or phrases in brackets are optional or may be modified to reflect the specific program.

General Instructions

The solicitation must inform the offerors of the basis for the award--the evaluation criteria and their importance. The following clauses may be used:

Proposals received in response to this solicitation will be evaluated by the Government [NAVAIR, NAVELEX, etc.] pursuant to Federal Acquisition Regulations. A contractor will be selected on the basis of his proposal being most advantageous to the Government, technical, cost and management factors considered.

Primary emphasis will be placed on the technical and cost factors; however, the technical factor will receive [more] emphasis than the cost factor. Within the technical area.... Within the cost area, Govern-

ment estimated cost will receive [more] emphasis than cost realism.

Offerors should also be informed that the source selection evaluation will address the realism or reasonableness of the their offers. The following clauses may be used:

An offeror's proposal is presumed to represent the best efforts to respond to the solicitation. Any inconsistency, whether real or apparent, between promised performance and cost should be explained in the proposal. For example, if the intended use of new and innovative production techniques is the basis for an abnormally low estimate, the nature of these techniques and their impact on cost should be explained; or, if a corporate policy decision has been made to absorb a portion of the estimated cost, that should be stated in the proposal. Any significant inconsistency, if unexplained, raises a fundamental issue of the offeror's understanding of the nature and scope of the work required and of the ability to perform the contract, and may be grounds for rejection of the proposal. The burden of proof as to cost credibility rests with the offeror.

Cost Evaluation Criteria

The solicitation should specify that both Government estimated cost and cost realism will be cost evaluation criteria. The following clauses may be used:

The cost evaluation shall consider and assess the most likely cost to the Government (including fee) and the realism or reasonableness of the offers. [The cost evaluation shall also consider and assess DTUPC and LCC.] The former is termed the Government estimated cost sub-criterion, and the latter is termed the cost realism sub-criterion. The award of a contract will be made not just on the basis of a low cost, but a realistically low cost. Both the Government estimated cost and the cost realism criteria involve the development by the Government of a realistic estimate for each offeror. [This estimate will be based on the offeror's design, a review of the tasks required to accomplish this effort, a determination of the required manpower and materials for each WBS element, and offeror's historical cost as demonstrated by the offeror. To assist with the Government evaluation, offerors are required to furnish the procedures and rationale used in compiling their proposed costs. All information such as IR&D efforts, etc., which an offeror wants the Government to consider in the cost evaluation must be disclosed.]

The cost evaluation criteria are defined as follows:

Government Estimated Cost. Government estimated cost will be assessed on the basis of the Government estimate of the realistic cost for each offeror. This estimate for each offeror will be evaluated [and scored numerically] to determine its comparative advantage to the Government. The lower the Government estimate, the better [or, the higher the score].

Cost Realism. The degree of cost realism in the offeror's cost proposal will be assessed in general by checking the completeness, accuracy, defensibility, and reasonableness of the proposal. Cost realism will also be assessed [and scored numerically] on the basis of the difference between the proposal (the bid or offer) and the Government estimate of the realistic cost for that offeror. The smaller this difference, the more realistic the offeror's proposed cost [and the higher the score]. An excessively high or low cost will indicate the offeror's lack of understanding of the requirements. Proposals may be penalized to the degree that the proposed costs are unrealistic.

Cost Proposal Data Requirements

In addition to mentioning the cost evaluation criteria, the solicitation should specify the WBS to be used and the type of back-up data required. By carefully developing the WBS and specifying the type of back-up data needed, the cost evaluation task, including development of a Government estimate, is made easier. The following clauses may be used:

The cost proposal shall be prepared using the work breakdown structure specified in Table X. Explain, in whatever detail is required, the methodology used to estimate each element of cost (e.g., labor, material, etc.) for each WBS element.

In all cases where cost estimates are based upon past experience, the offeror shall identify the past experience, explain how the past experience relates to the current effort, and explain how cost data available from the past experience were adapted to the current effort. If the past experience concerns a specific hardware item built or acquired in the past, the offeror shall identify the item, applicable dates and item cost.

In all cases where cost estimates are based upon learning/improvement curve applications, the offeror should identify the specific area subject to learning, the curve hypothesis (unit or cumulative) and the slope of the curve as a percent. Also, the offeror shall explain what data were used to develop the slope, how these data relate to the current effort and

how entry into the learning curve was attained, (e.g. how the first unit was derived).

Monthly manloading charts shall be provided for each WBS element. Also, monthly manloading charts shall be provided by functional labor category (i.e., engineering, manufacturing, management, etc.) for the total effort [or for level X WBS elements].

A chart shall be submitted which summarizes engineering, manufacturing and other direct labor category hourly rates. In addition, a chart shall be submitted which summarizes engineering, manufacturing, material handling, G&A, and other burden rates by year for the applicable years of the contract.

The offeror shall indicate whether labor and burden rates are Government approved bidding rates. If not, indicate the basis on which rates were established.

For all material items except major subcontracts and interdivisional transfers, provide a list of the high dollar items to cover approximately 80 percent of the total material cost. The list shall include the following: identification of the part(s); WBS element; word description [e.g., power supply, IC, capacitor]; quantity required by WBS element; total quantity for the contract; unit cost; total or extended cost; and the basis of the estimate. [A trace between the list and the price on the DD-633 shall be provided. This trace shall identify all factors, cost of each factor, and the method for estimating each, such as attrition, freight, variance, etc. The rationale for estimating material costs and choosing material sources shall be explained including a percentage breakout (by dollar value) of those based on quotes, engineering estimates, historical costs from previous procurements, etc.]

The offerors shall provide similar information as discussed above (i.e., costs, manloading charts, burden rates, material costs) for each of the major subcontractors.

The offerors shall provide a list of all tools, test equipment and facilities to perform the effort [except for those which will be provided as capital]. The estimated dollar value of each item shall be provided.

Computer programming (software) cost estimates shall include the method used to derive the cost estimate and the source of the information. A table shall be provided which itemizes the number of instructions per module and the estimated number of man-months per module. The estimate shall include all efforts from design through coding, debugging, and system test.

Best and Final Offer (BAFO) Instructions

After the proposals have been received and reviewed by the Government, and discussions/negotiations completed with offerors within the competitive range, the offerors are often provided an opportunity to submit proposal revisions (i.e., a BAFO). Instructions to the offerors submitting BAFOs should reiterate the importance of cost realism by including a clause such as the following:

The offeror must fully substantiate in the best-and-final offer any cost/price changes made to the original proposal. Lump sum reductions in cost/price will not be accepted without supporting rationale. Supporting data must provide traceability to the technical, business, or financial conditions that caused the change.

SECTION VII

GOVERNMENT ESTIMATE

The key to assessing the realism and reasonableness of cost proposals is the development of a realistic Government estimate for each offeror, which can be compared against that offeror's proposed cost. While a cost proposal can be analyzed and its realism judged on a piecemeal basis (e.g., examining a few major cost elements and commenting on the degree of realism), such an approach is generally not sufficient. The Government should make an estimate for each offer of the most likely cost that will be incurred as a result of awarding a contract to that offeror. An estimate of the most likely cost for each offeror is termed the "Government estimated cost" or "Government estimate" in this Handbook. The Government estimate for each offeror and the difference between the offer and the Government estimate for each offeror (i.e., the degree of realism) are the principal cost evaluation sub-criteria as discussed in Section V. Therefore, it is important that the Government estimates be realistic and reasonable.

The Government estimates should be based on a detailed evaluation of each offeror's proposal including the offeror's data, history and estimating techniques. The offerors should be required to justify the data, history and estimating techniques used. Both direct and indirect costs should be evaluated. Direct costs are direct labor, direct material, and other direct costs which are specifically and uniquely attributable to a particular product or service. Indirect costs are overhead, G&A and fee. Direct costs are the "nucleus" around which total contract price is built since the indirect costs are generally a function of direct costs.

The Federal Acquisition Regulations (FAR) define the type of cost analysis and evaluation that is required for cost-reimbursable contracts as follows:

The review and evaluation of a contractor's cost or pricing data and of the judgmental factors applied in projecting from the data to the estimated costs in order to form an opinion leading to a position on the

degree to which the contractor's proposed costs represent what contract performance should cost, assuming reasonable economy and efficiency... It includes appropriate verification of cost data, evaluation of specific elements of costs and projection of those data to determine the effect on price factors like cost necessity, allowance for contingencies, and the basis used for allocation of overhead costs.

The Government estimates need to be specific to each offeror as stated above. This is important because the costs likely to be incurred by each contractor may be different, sometimes significantly so, even though each contractor is expected to perform to the same set of requirements and statement of work. Some of the reasons that the costs differ among contractors are as follows. Labor rates differ due to geographical differences and labor mix differences. Overhead rates vary for many reasons including the projected business base of each contractor. Accounting systems differ including the classification of direct and indirect costs and the manner of distributing indirect costs. Facilities and capital equipment differ including the degree of automation (e.g., computer-aided-design (CAD) and computed-aided-manufacturing (CAM)). Manufacturing processes differ. Previous experience differs including related, relevant engineering drawings, "breadboards", and test equipment. Some contractors may have already performed relevant IR&D work.

In some cases a contractor's data and history may not apply or may not be appropriate in evaluating certain portions of a cost proposal. In these cases, parametric, analogy and other techniques of cost analysis which utilize cost data from a number of sources may be used. Estimates developed using these techniques may sometimes be adjusted to reflect differences between contractors. These techniques may also be used to cross-check estimates which are based on specific contractor cost data.

Parametric techniques involve the development and application of cost estimating relationships (CERs) based on the relationship between historical costs for systems or components

of systems and various technical, performance and other characteristics. Analogy techniques involve extrapolations from actual costs for similar systems. Other techniques may include the use of industry wide factors. Parametric and analogy techniques are the methods used for developing generic estimates of the type often used for budgetary estimates and are generally applied at a relatively aggregated level of the WBS.

A recommended methodology for developing a Government estimated cost for each offeror is as follows. The first step is an examination of the cost proposals and any backup data for completeness and consistency. Then, extensive "fact-finding" is conducted at the offerors' plants, where clarifications can be obtained, additional backup data examined, and the offerors asked to justify their cost estimates based on their actual experience on previous programs. Through such fact-finding, the validity and applicability of the offerors' data and estimating techniques can be determined. Alternatively, the offerors may be invited to Government offices to answer questions, but without access to their complete data bases the offerors are limited in the answers they can provide. For direct labor, some of the things examined are labor standards for repetitive type operations and manloading charts as a function of time for engineering and support activities. For direct materials, some of the things examined are the bill of materials and shrinkage factors (material lost during fabrication due to scrap, spoilage and obsolescence). In addition, labor rates, overhead rates, G&A rates, and vendor quotes are examined, generally by the Defense Contracts Audit Agency (DCAA). Based on this detailed analysis of direct and indirect costs, a realistic Government estimate is then prepared for each line of the WBS--accepting the contractor's estimate as is for that line or adjusting the contractor's estimate based on the analysis of the contractor's history, on the correction of any errors found, and on the use of the Government's data base for other programs when the contractor's history is lacking or not relevant.

The process of developing a Government estimated cost for each offeror is further described in the "Armed Services Procurement Regulation Manual for Contract Pricing"* under the subject "contract cost analysis". The process is also described in considerable detail in a Navy guide, "An Introduction to Direct Cost Analysis,**" which is the basis for a one-week course taught regularly at the Navy Acquisition/Logistics Management Training Center in Washington, D.C., and at other locations from time to time. The guide and the course were largely developed by Irwin Neveleff of NAVELEX.

In developing a Government estimated cost, a well structured WBS and a careful, thoughtful specification for cost backup data in the solicitation can make the task easier for the cost evaluation team, as discussed in the previous section.

The parametric and analogy techniques discussed above may be used to develop estimates of a program prior to receipt of the contractors' proposals. These estimates can then be compared with the contractors' proposals to indicate areas where the detailed fact-finding should be directed (i.e., areas that have the greatest potential payoff). This could reduce the amount of analysis and time required (and presumably personnel resources required) during the detailed fact-finding. Sometimes, cost estimates will already have been prepared for budget purposes or program review purposes. These estimates may only require updating and tailoring to the specific requirements of the solicitation.

Technical risks must be considered in preparing the Government estimates. Engineers from the program office, source selection organization and the Defense Contract Administration Service (DCAS) may assist in the risk assessment and cost evaluation. It also helps if some of the cost analysts preparing the Government estimates have an engineering background.

* Armed Services Procurement Regulation Manual for Contract Pricing, ASPM No. 1, edition of 15 September 1975.

** An Introduction to Direct Cost Analysis: A Basic "How-to" Guide for NAVSEC F-COG and S-COG Negotiated Production Procurements, Revision 1, 2 July 1973.

Since there are technical and program (e.g., schedule) risks and uncertainties associated with any program, as well as uncertainties in cost estimating data and techniques, there is often considerable uncertainty in the Government estimates. Therefore, it is important to take into account the uncertainty associated with the Government estimates when judging the realism of the offerors' proposed costs. The greater the degree of uncertainty in a Government estimate, the more admissible are greater differences between the proposed cost and the Government estimate. To provide an indication of uncertainty, it may be desirable to estimate a range of costs for each WBS item, rather than just a point (most likely) estimate. These ranges and most likely estimates can then be used to characterize the cost uncertainty. However, because there is a great deal of subjectivity in establishing such ranges and because certain risks and uncertainties may not even be considered, it is difficult to obtain a clear, consistent characterization of the cost uncertainty. This is further complicated in that some risks and uncertainties (such as scope changes) should not be taken into account in evaluating cost proposals. Cost uncertainty is discussed further in the next section.

It is also important to achieve consistency in the Government estimates for different offerors. All offerors are proposing to the same requirements, but their approaches will differ and the requirements will not be specific in all areas. Therefore, different conclusions will be reached regarding such things as the number of tests required of each type. In some cases, these differences between offerors may be reasonable because, for example, offerors may use different design approaches and will have different prior design and testing experience. In other cases, the differences may not be reasonable because, for example, the number of flight tests finally negotiated might be the same regardless of offeror. Therefore, in some cases, the cost proposals should be put on a common basis. This is more important for evaluating Government estimated cost than cost realism since cost realism is evaluated

relative to the Government estimated cost which, for any offeror, will be on a common basis with the cost proposal for that offeror.

Methodology: Develop a Government estimate for each offeror based on a detailed evaluation of that offeror's proposal, including fact-finding as appropriate. The offerors should be required to justify the data and techniques used in developing their cost proposals. If time and resources permit, estimates based on parametric and analogy techniques should also be made as a cross-check.

SECTION VIII

EVALUATION

A. EVALUATION ALTERNATIVES

Considerable information is developed on the strengths and weaknesses of each of the offerors' proposals during the source selection evaluation of technical, cost and other factors. This information needs to be summarized and structured in such a way as to provide the Source Selection Authority (SSA) with a sound basis for making an award. Generally, the offerors are rated or scored for each of the evaluation sub-criteria, which are then weighted to produce an overall rating or score. The evaluators may assign numerical scores (e.g., zero to 10) or adjectival ratings (e.g., excellent, unsatisfactory, etc). Sometimes, the adjectival ratings are converted to numerical scores so that an overall score can be developed. A variation of adjectival rating is color rating, in which colors represent various degrees of acceptability (e.g., blue for exceptional). In some cases, the evaluation sub-criteria--particularly those related to cost--may not be rated or scored at all. However, in such cases a narrative evaluation would generally be provided. Also, tabular and graphical displays may be useful.

These various evaluation alternatives are summarized below:

NO RATING OR SCORING

- Narrative
- Tabular
- Graphical

QUALITATIVE RATING

- Adjectival
- Color

NUMERICAL SCORING

- No weighting
- Weighting cost sub-criteria only
- Weighting all evaluation criteria

As indicated above, numerical scores can be weighted in three ways. First is no weighting (that is no numerical weighting); the scores provide an understanding of how the offerors rank for a particular evaluation sub-criterion. Second, the cost sub-criteria alone can be weighted which provides an understanding of the ranking for the combined cost sub-criteria. Third, cost can be weighted with all of the other evaluation criteria. It is this latter weighting that is generally implied by numerical scoring.

Whether qualitative ratings or numerical scores are used, they should be considered as means of communication with the SSA which are used by the SSA along with other factors, such as narrative information.

While numerical scoring of both Government estimated cost and cost realism for each contractor appears to have considerable merit, it is presently discouraged by some Defense organizations. The advantage of scoring cost numerically, assuming an appropriate methodology is used, is that it provides the SSA with a clearer understanding of each offeror's relative ranking than an adjectival or color ranking. However, the SSA needs sufficient flexibility and discretion with any evaluation method to award to the offeror who provides the best value, all factors considered. Such flexibility is particularly important when using numerical scoring, because the SSA does not want to be driven to an irrational decision based on an overly elaborate and too inflexible scoring system. Careful selection of scoring rules and evaluation criteria weights can minimize any problems. Also, it should be clearly recognized that numerical scores are not precise despite the aura of precision they give. Numerical scores are only approximate and small differences in scores may not be significant. Numerical scores should not be the sole basis for an award. The SSA must take into account all pertinent quantitative and qualitative information.

The various evaluation alternatives are discussed in more detail in the following subsections.

B. NON-NUMERICAL EVALUATION

Narrative evaluations may be used alone, but are generally used as supplementary information to the qualitative ratings or numerical scores. The narrative should provide a clear, concise summary of the main strengths and weaknesses of the proposal in the areas defined by the evaluation criteria (or sub-criteria). Where qualitative ratings are used, the narrative should also provide specific rationale for the adjective or color rating. Where numerical scores are used, the narrative should provide information that may not be reflected in the scores, but which should be considered in interpreting the scores.

Tabular and graphical displays may also be used alone or as supplementary information to the qualitative ratings or numerical scores. Tabular and graphical displays using only the key cost data--the offers and the Government estimated costs--can convey a great deal of information if properly constructed. A suggested tabular display is shown below:

CONTRACTOR	OFFER (C)	GOV'T ESTIMATE (G)	GOV'T EST DELTA IN % (D)	REALISM DELTA IN % (D')
A				
B				
C				
D				
:				

The Government estimate delta is the difference between the Government estimate and the lowest Government estimate for any contractor expressed in percentage terms. The cost realism delta is the difference between the offer and the Government estimate expressed in percentage terms. These deltas provide a clear, convenient display of the cost premium that would have to be paid and the degree of realism of each contractor. The deltas are figured as follows:

$$\text{Gov't Estimated Cost Delta} = \frac{G - G^*}{G^*} \times 100 \% = D$$

$$\text{Cost Realism Delta} = \frac{C - G}{G} \times 100 \% = D'$$

Where: C = Offer
 G = Government Estimated Cost
 G* = Lowest Government Estimated Cost
 D = Government Estimated Cost Delta (%)
 and D' = Cost Realism Delta (%)

While the above tabular display is simple and may appear trivial, it can be of great value to the source selection team and the SSA.

Graphical presentations of key cost data may also be useful. Two types are shown in Figure 8.1.

Qualitative rating involves assigning an adjectival or color rating or grade for each evaluation criterion for each offeror. The ratings to be used are determined in advance, and each possible rating is clearly defined and evaluation criteria or standards are established, so that evaluators will be able to assign a rating with a minimum of ambiguity. Some of the adjectival ratings that are used are: Excellent, Very Good, Average, Poor, and Unsatisfactory; Exceptional, Acceptable, and Unacceptable; and A, B, C, D, and F. The color ratings developed by the Air Force are: Blue, Green, Yellow and Red, which correspond to exceptional, meets standards, fails to meet standards and unacceptable, respectively.

Adjectival and color ratings are sometimes converted to numerical scores by assigning a number or a range of numbers to each adjective or color. By quantifying the rating, weighting of the evaluation criteria to develop an overall rating is facilitated. The alternative is a very subjective weighting.

One of the main disadvantages of adjectival and color ratings is that two offerors may be much closer in relative merit than their ratings indicate. This is because the ratings represent a step-function, and offerors on the borderline

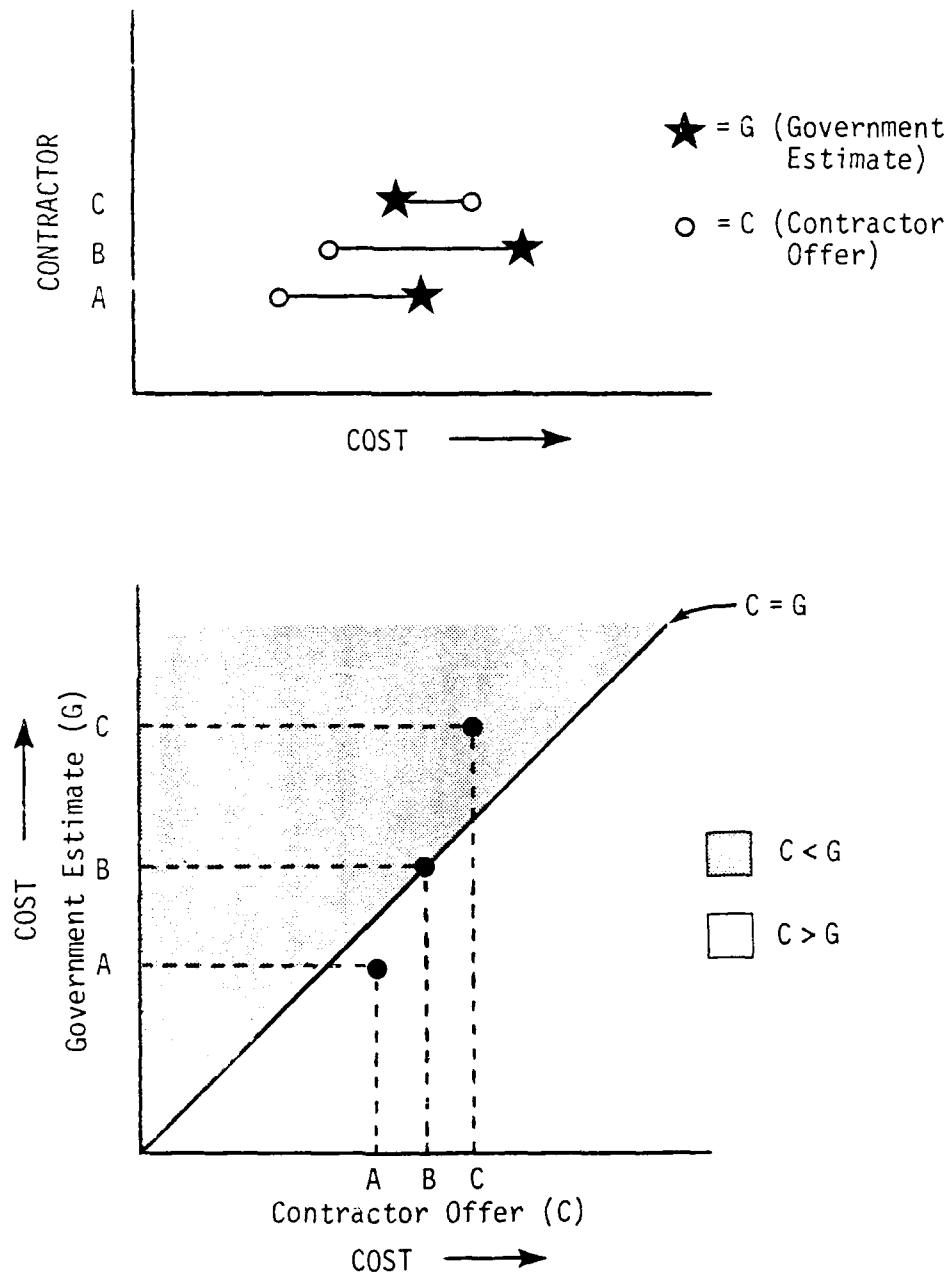
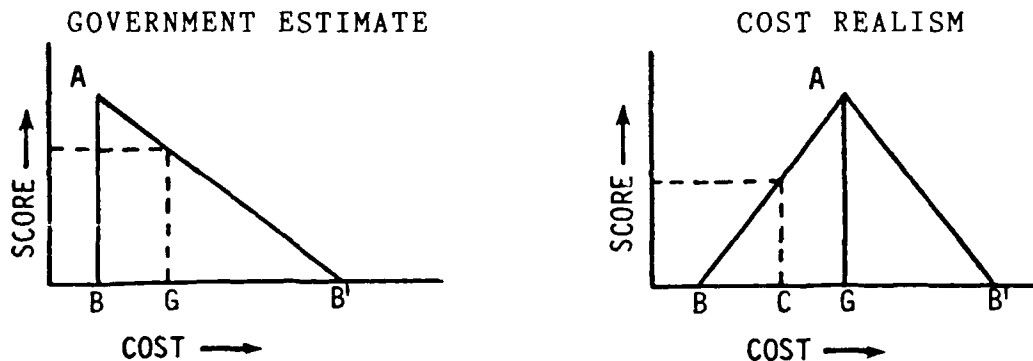


Figure 8.1 Graphical Presentations of Cost Evaluation Data

between two ratings may be very close but be given different ratings.

C. NUMERICAL SCORING

The basic notion for determining a numerical score is very straightforward: for the Government estimated cost (G), the greater the Government estimate the lower the score; for cost realism, the greater the difference between the Government estimate (G) and the offer (C), the lower the score. This is shown graphically below:

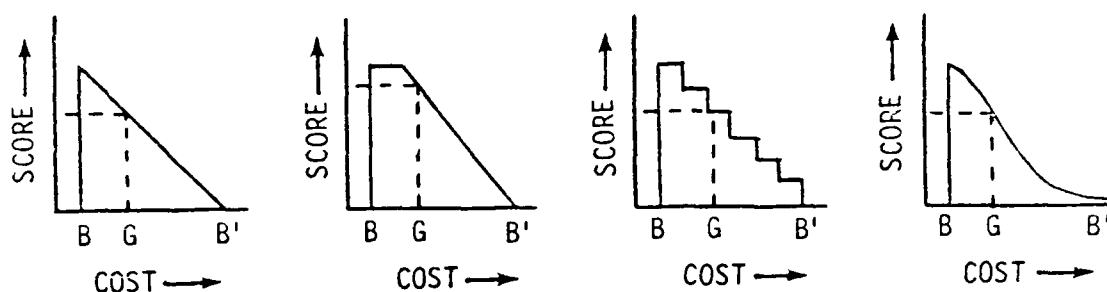


These figures are general representations of scoring rules. "A", "B", and "B'" are arbitrary points; "G" is the Government estimated cost for a particular contractor and "C" is the contractor's offer. The change in score as a result of moving along the line AB' for Government estimated cost and along the line AB or AB' for cost realism is shown as a straight line for simplicity, but in the general case the lines might be some other shape, as discussed below. The score is usually based on a scale of 0 to 10 with 10 being the maximum score.

The scoring rules are discussed in detail below. The Government estimated cost scoring rules are discussed first. The cost realism scoring rules are discussed beginning on page 8-13. Design-to-Unit Production Cost (DTUPC) and Life Cycle Cost (LCC) scoring rules are not discussed in this Handbook, but the same procedures discussed below for Government estimated cost could be used.

Government Estimated Cost Scoring Rule

As mentioned above, the basic notion for scoring Government estimated cost is very straightforward: the greater the Government estimate, the lower the score. Referring to the above figure for Government estimated cost, the score associated with any Government estimated cost, G (where G differs for each offeror), depends on the shape of the line AB' and the values for B and B' . Some of the shapes the scoring rule could take are triangle, trapezoid, stepped and various smooth curves (e.g., a normal curve), as represented below:



The triangle is a simple scaling rule. For a Government estimated cost of B , the score is a maximum (e.g., 10). For Government estimates greater than B , the score decreases linearly to a minimum (e.g., 0) at B' . B may be less than or equal to the lowest Government estimate, G^* , for the different offerors (if B is greater than G^* , then in effect the triangle is a trapezoid scoring rule).

The trapezoid scoring rule differs from the triangle scoring rule only in that the top of the triangle is cut off, such that Government estimates sufficiently close to the lowest Government estimate (e.g., within a couple of percent) receive the maximum score.

The stepped scoring rule is another variation of the triangle and derives from assigning the same score to a range of costs. For example, a score of 10 is assigned to all contractors with Government estimates within 5 percent of B , a score of 9 to all contractors within a range 5 to 10 percent of B , etc. While the stepped scoring rule can be presented in a simple

table, it has the undesirable property that it may give quite different scores to two contractors with similar Government estimates. For instance, based on the above example, two contractors with Government estimates that are 4.9 and 5.1 percent higher than B would receive scores of 10 and 9, respectively. As mentioned earlier, adjectival and color ratings are also step-functions.

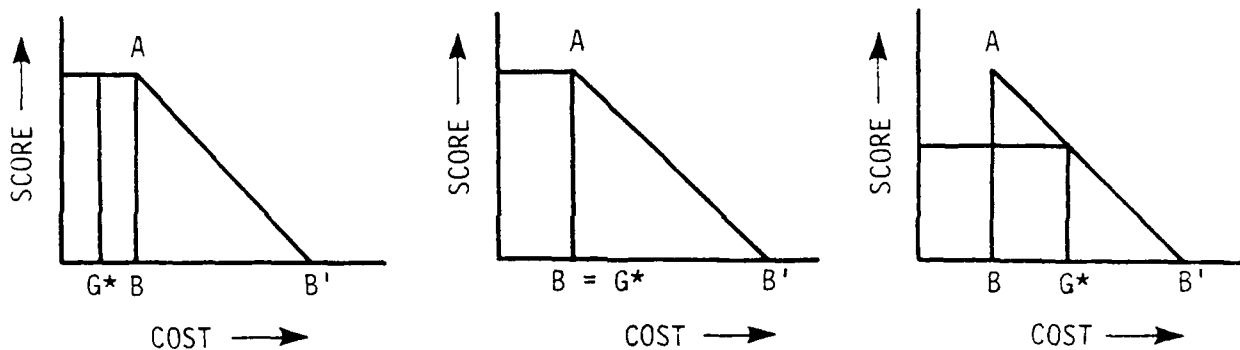
Various smooth curves can also be used as scoring rules. A normal curve is a particularly convenient form of a smooth curve. The parameters of a normal curve can be chosen such that a normal curve scoring rule closely approximates a triangle or trapezoid scoring rule. The advantage of a normal curve scoring rule is that it does not have a sharp discontinuity at B' as do the triangle and trapezoid.

A triangle scoring rule or a normal curve scoring rule approximating a triangle are the preferred shapes for a Government estimated cost scoring rule. The main reason is that the score decreases linearly as the Government estimated cost increases, which appears sensible. Also, these scoring rules give more logical results than a trapezoid scoring rule for the tradeoff analyses discussed in Section IX. A stepped scoring rule is not preferred for the reasons already given.

While the normal curve scoring rule has the advantage over the triangle scoring rule of being a smooth, continuous curve, it is not as easy to explain and understand. Furthermore, a normal curve is generally associated with statistical probabilities or with uncertainties--connotations which are not appropriate in this case. Also, the scores given by the two types of scoring rules can be very similar (depending on the curve parameters chosen) in the range B to B'. Therefore, the following discussion assumes a triangle scoring rule. Normal curve scoring rules are discussed in Appendix E.

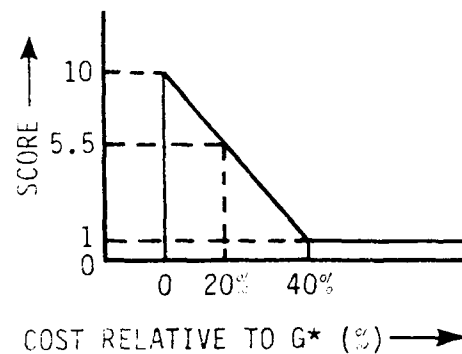
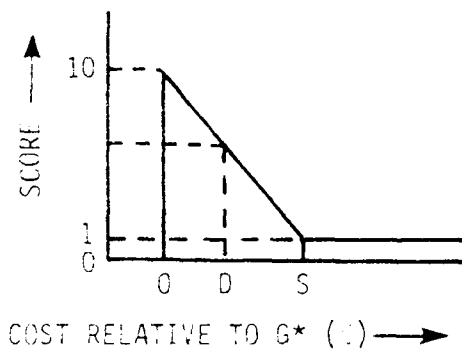
In order to use the triangle scoring rule, four values must be determined--the maximum score, the minimum score, B and B' (refer to the figure on page 8-6). It is convenient to set the maximum score at 10. The minimum score may be set at 0 or 1.

With a minimum score of 1, it is easier to define triangle and normal curve scoring rules which approximate each other, as discussed in Appendix E. For this reason, a value of 1 is preferred in this Handbook. Also, by using a value of 1 each offeror gets a minimum score of 1 for effort. B, the Government estimate for which the score is a maximum of 10, should generally be set equal to the lowest Government estimate for any offeror, G^* , for the following reasons. If G^* is substantially less than B, then a trapezoid is formed with a maximum score given for G^* as well as for Government estimates substantially more than G^* . If G^* is substantially more than B, then even the offeror with the lowest Government estimate will have a score substantially less than the maximum. The effect of different values for B is shown graphically below:



The remaining value that has to be established is B' , the Government estimated cost above which the score is a minimum of 1. First, it is convenient to express the "Cost" on the X-axis of the center figure above in terms of the Government cost estimate delta, D , defined above for the tabular display. The delta is the difference between the Government estimate and the lowest Government estimate for any contractor expressed in percentage terms. That is D equals $(G - G^*)/G^*$. The delta for a maximum score is zero [$(G^* - G^*)/G^* = 0$]. That is the offeror with the lowest Government estimate receives the maximum score. The delta at which the score reaches a minimum score of 1 is termed the "spread" of the scoring rule [$(B' - G^*)/G^* = S$]. For example, if the spread is 40 percent, an offeror whose Govern-

ment estimated cost is 40 percent greater than the lowest Government estimated cost for any of the competitors receives a score of 1. An offeror whose Government estimated cost is 20 percent greater receives a score of 5.5. By using the delta instead of the Government estimated cost as the X-axis, the magnitude of the difference between the offerors is readily apparent, and all offerors can be shown on a single graph of the scoring rule. The triangle scoring rule is shown below using the delta--both the general case and an example with the spread equal to 40 percent are shown.



Having established the maximum and minimum scores and having set B equal to G^* , the scoring rule is a function only of the spread, S. Since all offerors with D greater than S will have the same minimum score of one, if S is too small, there will not be sufficient differentiation between offerors. And, if S is too large, even very expensive offerors (as measured by the Government estimates) will still receive scores above the minimum of one and large differences in the Government estimates will result in only small differences in score. Therefore, the spread must be chosen with care. It is important for the source selection team to analyze the effects of different spreads--different values of S--as well as different weights for the Government estimated cost sub-criterion. The determination of the spread is discussed next. The determination of the cost evaluation weights will be discussed later in this section.

Government Estimated Cost Scoring Rule Spread

As mentioned above, if the spread is too small, there will not be sufficient differentiation between offerors. And, if the spread is too large, even very expensive offerors (as measured by the Government estimates) will still receive scores well above the minimum. This is illustrated below:

SCORES FOR DIFFERENT SPREADS AND DELTAS

Spread (S)	Delta (D)						
	10%	20%	30%	40%	50%	60%	70%
20%	5.5	1.0	1.0	1.0	1.0	1.0	1.0
40%	7.8	5.5	3.3	1.0	1.0	1.0	1.0
60%	8.5	7.0	5.5	4.0	2.5	1.0	1.0

At what point should the Government estimate for an offeror be considered too high relative to the Government estimates for other offerors? Given that all offerors propose to the same set of requirements, their costs should not differ widely except possibly to account for such factors as variant design approaches, labor and overhead rates, and efficiencies. It seems reasonable that there would be a much greater likelihood that G would be reasonably close to G^* , say within 10 to 20 percent, than far from G^* , say 50 to 100 percent.

To test this, Government estimates for eight NAVELEX programs were examined. The Government estimate or estimates which were not the lowest for each program are shown in the histogram in Figure 8-2 (BAFO estimates were used). When a normal curve is fitted to the histogram, the resulting standard deviation (σ) is 18 percent. In other words, there was a 68 percent likelihood that the Government estimates were within 18 percent of the lowest Government estimate and a 95 percent likelihood that the Government estimates were within 36 percent (2σ). The (2σ) point corresponds roughly to the spread, S , of a triangle scoring rule (see Appendix E for an explanation). Based on this sample, a scoring rule with a spread of 30 to 40 percent would provide a reasonable differentiation between offerors.

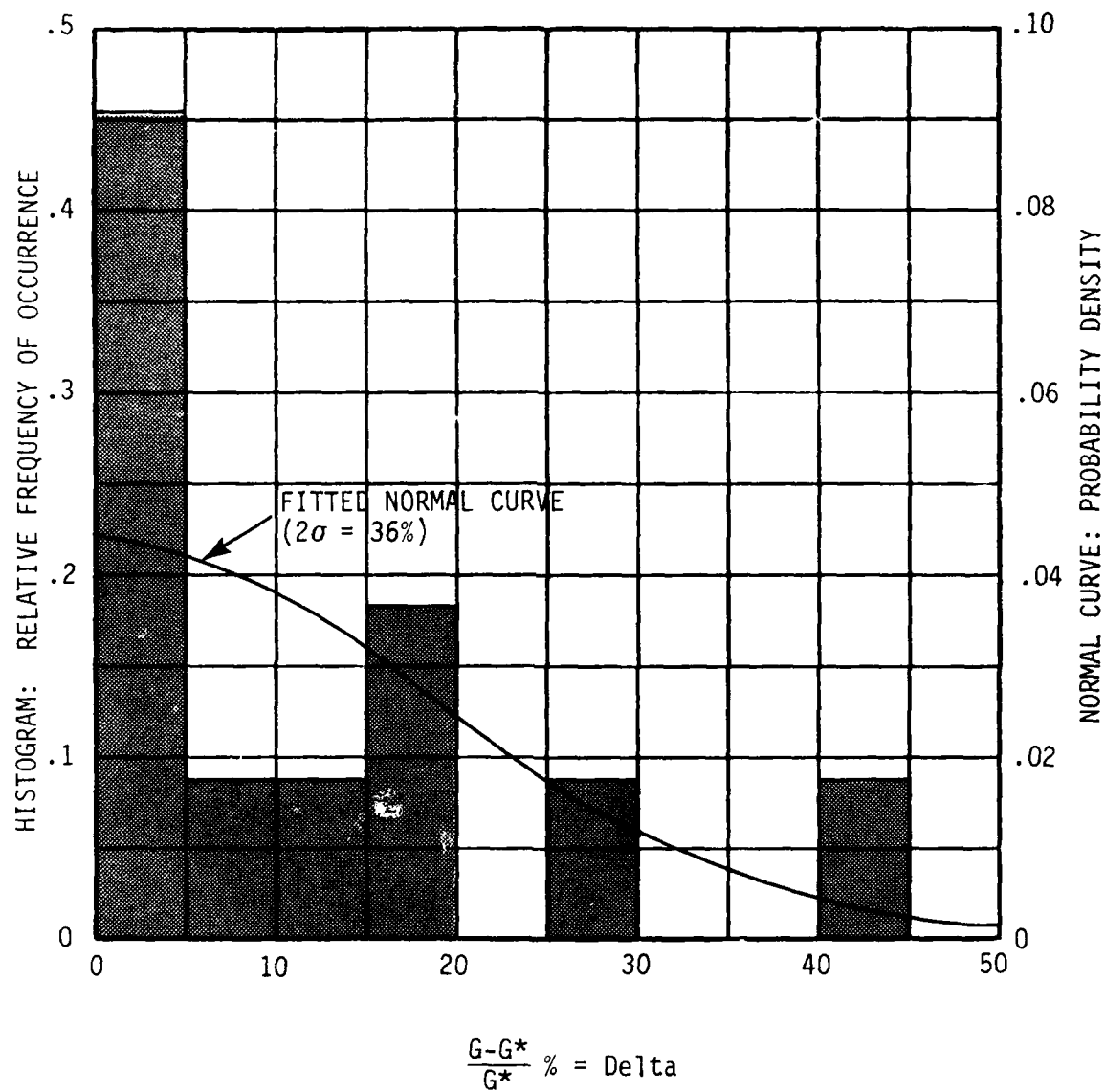


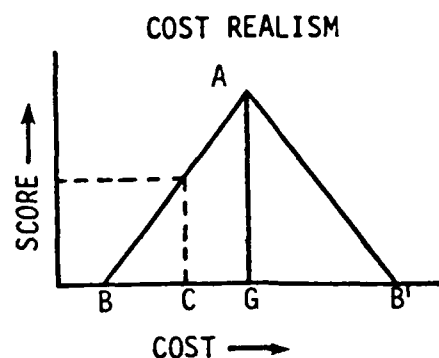
Figure 8.2 Government Estimated Cost Histogram for Eight NAVELEX Programs

The NAVELEX data were also analyzed as follows. The Government estimate or estimates which were not the lowest were 16 percent greater on average than the G^* for each program. Half of the time the Government estimate that was not the lowest was within 10 percent of G^* and two thirds of the time was within 20 percent. The greatest difference from G^* was a little more than 40 percent. Again, based on the sample, a spread of 30 to 40 percent seems reasonable.

There is no "best" spread to use. Different spreads may be appropriate for different stages of development, different types of hardware, and other program differences. Therefore, in determining an appropriate spread, the source selection cost evaluation team should consider these various factors, as well as how much it wants to differentiate scores for offerors with various deltas. And, sensitivity and tradeoff analyses of the effects of different scoring rule spreads and different weights should be made, as discussed in Section IX.

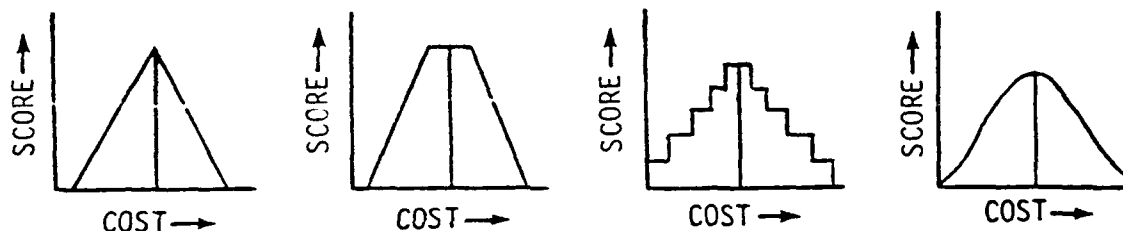
Cost Realism Scoring Rule

Earlier in this section it was mentioned that the basic notion for scoring cost realism is very straightforward: the greater the difference between the Government estimate (G) and the offer (C), the lower the score. The graph that was shown is repeated below:



AB and AB' are shown as straight lines for simplicity, but in the general case might be some other shape. The score associated with any difference ($C-G$) depends on the shape of the

line BAB' and the values for B and B'. The differences B'-G and G-B may be the same, in which case the scoring rule is "symmetrical" (assuming the lines AB and AB' are the same shape). If B'-G and G-B are different, then the scoring rule is "skewed." There does not appear to be an obvious rationale for giving one offeror at some percentage below the Government estimate a different score from another the same percentage above the Government estimate. For this reason and for simplicity, symmetry is assumed in the following discussion. Some of the shapes the scoring rule could take are triangle, trapezoid, stepped, and various smooth curves (e.g., a normal curve). These shapes were illustrated earlier for the Government estimated cost, and the illustrations are repeated below:



The triangle is a simple scaling rule. If the difference between G and C is zero, the score is a maximum--say, 10. If C is more than B' or less than B, the score is a minimum--say, zero. In between, the score is proportional to the difference between G and C.

The trapezoid scoring rule differs from the triangle scoring rule only in that the top of the triangle is cut off, giving it a trapezoid or mesa shape. The rationale is that offers sufficiently close to the Government estimate (e.g., within a couple of percent) should receive the maximum score. This gives some recognition of the uncertainty associated with the Government estimate. Uncertainty is discussed later.

The stepped scoring rule is another variation of the triangle and derives from assigning the same score to a range of offers. As discussed earlier, the stepped scoring rule has the

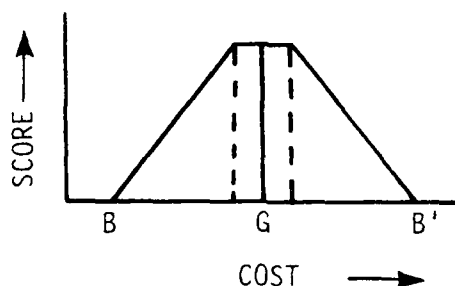
undesirable property of attributing quite different scores to two contractors with similar degrees of cost realism (i.e., if the two scores are on either side of a step break).

Various smooth curves can also be used as scoring rules. A normal curve (a "bell" shaped curve) is a particularly convenient form of a smooth curve. The parameters of a normal curve can be chosen such that a normal curve scoring rule closely approximates a triangle or trapezoid scoring rule. The advantage of a normal curve scoring rule is that it does not have sharp discontinuities at B and B' as do the triangle and trapezoid.

A trapezoid scoring rule or a normal curve scoring rule are the preferred shapes for a cost realism scoring rule. The main reason is that offers sufficiently close to the Government estimate (e.g., within a couple of percent) receive the maximum score or very close to the maximum score. As stated above, this gives some recognition of the uncertainty associated with the Government estimate. A stepped scoring rule is not preferred for the reasons already given.

The following discussion assumes a trapezoid scoring rule. Normal curve scoring rules are discussed in Appendix E.

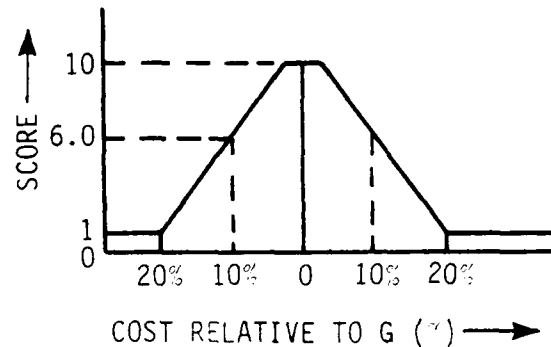
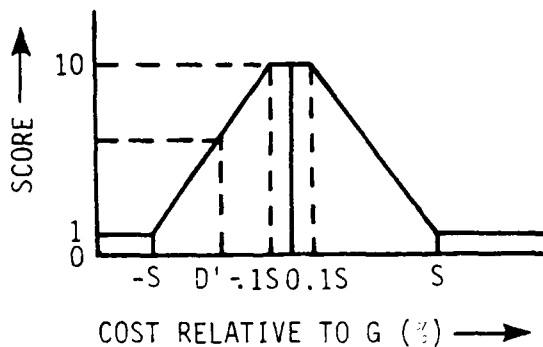
In order to use the trapezoid scoring rule, six values must be determined--the maximum score, the minimum score, B, B', and the range of values for which the score is a maximum--the "plateau". The scoring rule is shown below.



It is convenient to set the maximum score at 10. The minimum score may be set at 0 or 1. A value of 1 is preferred

for the same reasons given for the Government estimated cost scoring rule.

Before proceeding, it is convenient to express the "Cost" on the X-axis of the scoring rule in terms of the cost realism delta, D' , defined earlier for the tabular display. The delta is the difference between the offer and the Government estimate expressed in percentage terms. That is D' equals $(C-G)/G$. It is also convenient to assume symmetry such that offers higher or lower than the Government estimate by the same amount receive the same score. If the Government estimate is the same as the offer, the score is a maximum of 10 and the delta is zero [$(C-G)/G = 0$]. The score reaches a minimum of 1 for $(B-G)/G = -S$ for offers less than G and for $(B'-G)/G = S$ for offers greater than G . S is termed the "spread" and has the same meaning as for the Government estimated cost scoring rule. The plateau, the deltas for which the score is a maximum of 10, should be small compared to the total spread of $-S$ to S . It is convenient to set the plateau at 10 percent of the total spread. Thus, the score is a maximum of 10 from $-0.1 S$ to $0.1 S$. The trapezoid scoring rule is shown below using the delta--both the general case and an example with the spread equal to 20% are shown.



As indicated in the figure on the right, an offeror whose offer is 20 percent higher or lower than the Government estimate receives a score of 1. An offeror whose offer is 10 percent higher or lower receives a score of 6. An offeror within two percent of the Government estimate receives a score of 10. By using the delta instead of the cost as the X-axis, the degree of

cost realism is readily apparent, and all offerors can be shown on a single graph of the scoring rule.

Having established the maximum and minimum scores and having set the plateau at some fixed percentage of the spread (e.g., 10 percent), the scoring rule is a function only of the spread, S . Since all offerors with D' greater than S will have the same minimum score of one, if S is too small, there will not be sufficient differentiation between offerors. And, if S is too large, even very unrealistic offerors will still receive scores above the minimum of one and large differences in the degree of realism will result in only small differences in score. Therefore, the spread must be chosen with care. It is important for the source selection team to analyze the effects of different spreads--different values of S --as well as different weights for the cost realism sub-criterion. The determination of the spread is discussed next. The determination of the cost evaluation weights will be discussed later in this section.

Cost Realism Scoring Rule Spread

As mentioned above, if the spread is too small, there will not be sufficient differentiation between offers. And, if the spread is too large, even very unrealistic offers will still receive scores well above the minimum score and large differences in realism will result in only small differences in score.

A spread of 15 to 25 percent appears to be reasonable for defining a cost realism scoring rule. Offers more than 15 to 20 percent from a carefully prepared Government estimate, relying primarily on the offeror's own data, certainly raise a question as to cost realism. Of course, what is realistic will depend to some extent on the nature of the development program--the risks involved, how much of the system has been previously designed, etc. It seems reasonable to assume that offers more than 15 to 25 percent from the Government estimate, depending upon the particular program, are unrealistic and should receive close to a minimum score. The low end of this suggested range, 15

percent, would apply only if the program was well defined, there were few risks or unknowns and there existed a good data base on which to base cost estimates.

A range of no more than 25 percent for the scoring rule spread is supported by data for eight NAVELEX programs. Cost realism (i.e., D') was determined for 19 offers made on the eight programs, as shown in the histogram in Figure 8-3 (BAFO estimates were used). When a normal curve is fitted to the histogram, the resulting standard deviation (σ) is 13 percent. In other words, there was a 68 percent likelihood that the offers were within 13 percent of the Government estimate and a 95 percent likelihood that the offers were within 27 percent (2σ). The 2σ point corresponds roughly to the spread, S , of a trapezoid scoring rule (see Appendix E for an explanation). Based on this sample, a scoring rule with a spread of 25 percent or less would provide a reasonable differentiation between offerors.

The NAVELEX data were also analyzed as follows. The average cost realism delta, D' , was 9 percent, and 84 percent of the time D' was less than 25 percent. Again, based on the sample, a spread of 25 percent or less seems reasonable.

There is no "best" spread to use. Different spreads may be appropriate for different stages of development, different types of hardware, and other program differences. Therefore, in determining an appropriate spread, the source selection cost evaluation team should consider these various factors, as well as how much it wants to differentiate scores for offerors with various deltas. And, sensitivity and tradeoff analyses of the effects of different scoring rule spreads and different weights should be made, as discussed in Section IX. Consideration should also be given to the potential uncertainties in the Government estimates, and the scoring rule spread should be at least as great as the uncertainty, as discussed next.

Uncertainty

The previous section, on the Government estimate, briefly discussed uncertainty, pointing out that considerable uncertain-

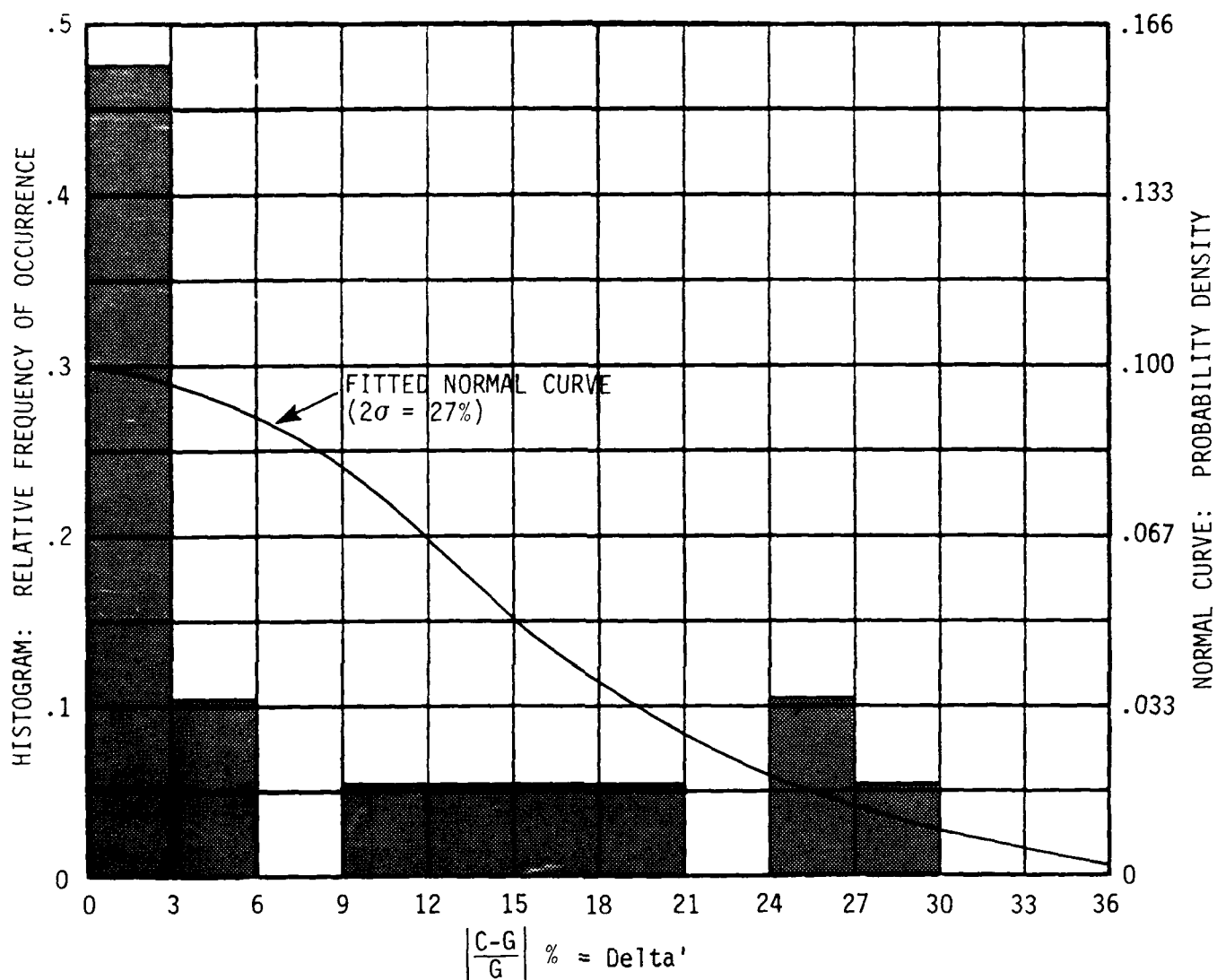


Figure 8.3. Cost Realism Histogram for Eight NAVELEX Programs

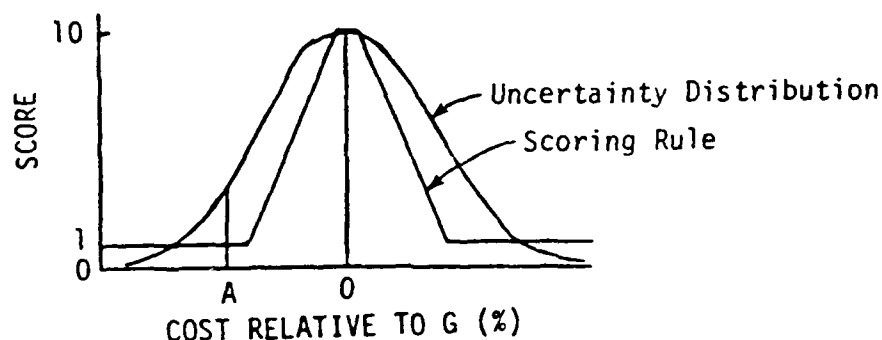
ty in the Government estimate derives from technical and program (e.g., schedule) risks and from uncertainties associated with cost estimating data and techniques. It is therefore important to take into account the uncertainty associated with the Government estimate when judging the realism of the offeror's proposed cost. The greater the degree of uncertainty in the Government estimate, the more admissible are greater differences between an offer made by a contractor and the Government estimated cost for that contractor.

A cost realism scoring rule can make two kinds of errors, as pointed out by Ling and Wallenius*:

Type A error--assigning a higher score than warranted to an improbable proposed cost, and

Type B error--assigning a lower score than deserved to a highly plausible proposed cost.

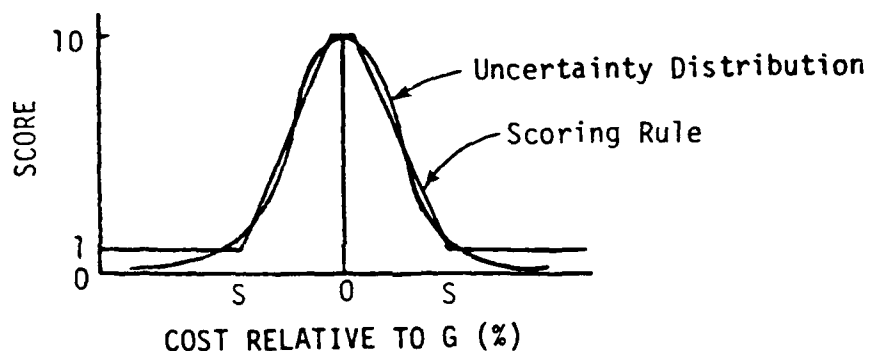
Type B errors result if the spread in uncertainty is greater than the spread in the scoring rule. This is undesirable because offers with a reasonable likelihood of matching the Government estimate would receive a score at or close to the minimum. This is illustrated below with a trapezoid scoring rule and a hypothetical uncertainty distribution:



* Ling and Wallenius, Cost Realism, Technical Report #400, Department of Mathematical Sciences, Clemson University, December 31, 1982.

Offeror A receives the minimum score even though there is a reasonable likelihood it could in fact match or closely approximate the Government estimate.

Type A errors result if the spread in uncertainty is less than the spread in the scoring rule. This does not appear to be of concern as far as scoring is concerned. Although various offers may be unrealistic--clearly more or less than they would have been had the offerors been realistic or more careful--the scoring rule should differentiate among these unrealistic estimates, at least to a point. However, the scoring rule, if given the same spread as the uncertainty, would give a minimum cost realism score to all unrealistic offers with deltas (D') greater than the spread (S). This is illustrated below:



For example, if various offers had deltas between zero and 20 percent and the spread was significantly less than 20 percent, say 10 percent, then all offers with deltas between 10 and 20 percent would receive the minimum score, and thus there would be no differentiation of scores.

It seems unlikely that the uncertainty spread would be greater than a scoring rule spread of 15 to 25 percent given that the uncertainty and risk associated with a Government estimate is a function of the stated requirements in the solicitation (e.g., no scope changes or redirections) and that the main uncertainty will be in the interpretation and use of each offeror's cost data and history. Also, since the offers and Government estimates generally use audited labor and overhead

rates, no uncertainty in these rates is generally taken into account.

One method for understanding the possible effects of uncertainty in the Government estimate on the cost realism scores is to perform a sensitivity analysis to see the effects of a few percent change in the Government estimate on the cost realism scores. Any change in the ranking of two offerors, due to such a small change in the Government estimate, would indicate that there is no significant difference in the cost realism of these offerors.

In conclusion, unless there is concern that the uncertainty spread is greater than the scoring rule spread, it does not appear necessary to determine uncertainty in the Government estimate for a particular program or to adjust the spread of the scoring rule accordingly. Benefits other than to cost realism scoring may, however, derive from determining the uncertainty. An uncertainty assessment would clearly lead to a better understanding of the cost estimates and would highlight certain areas warranting closer attention in the source selection evaluation and closer control during contract execution.

Combined Scores

The overall cost evaluation score depends on the scores for Government estimated cost and cost realism. The overall source selection evaluation score depends upon the scores and the weights for each factor--cost, technical, management, etc. The cost evaluation team with assistance from the technical team, as appropriate, should analyze the effects of (1) different scoring rules (e.g., trapezoid versus normal curve), (2) different scoring rule spreads, and (3) different weights. The trapezoid and normal curve scoring rules can produce very similar results as discussed above. The triangle and trapezoid scoring rules have been emphasized because they are easier to explain and understand. However, some may prefer the normal curve which is discussed in detail in Appendix E. The determination of appropriate scoring rule spreads based primarily on differentiating

the scores of various offerors was discussed above. The determination of appropriate spreads and weights through sensitivity analyses and tradeoff analyses is the subject of the next section.

Miscellaneous Considerations

Some miscellaneous considerations related to numerical scoring are as follows:

a.) This Handbook assesses cost realism in terms of the difference between an offer and the Government estimate of the offeror's total cost. Cost realism could also be assessed in terms of the sum of the absolute values of the differences for each WBS item. Differences at the WBS item level are of some interest. However, generally the main concern in assessing cost realism is the comparison of the total offer to the total Government estimate in order to indicate whether an offeror may be buying-in, which would put the Government into a built-in cost growth position. Furthermore, total cost estimates are better than they would be otherwise, given the high degree of uncertainty in cost estimates, because errors on the high side and errors on the low side cancel out to some extent. Likewise, in execution of a contract, underspending in some WBS line items and overspending in others will cancel to some extent. Therefore, it seems fair to assess cost realism in terms of the algebraic sum of the differences between the offer and the Government estimate at the WBS item level (i.e., the net differences) and not the sum of the absolute values of the differences at the WBS level. But, as stated above, differences at the WBS item level are of interest. For example, there would be more confidence in an offeror whose small differences at the WBS item level completely cancelled out than in an offeror with large differences which also cancelled out completely. Large differences may indicate that an offeror lacks understanding of the requirements and should be highlighted in the narrative cost evaluation.

b.) For a particular procurement, the shape and spread of the uncertainty distribution for the Government estimate would differ for each of the offerors. Because of the difficulty in characterizing uncertainty, it is difficult to know both the extent of such differences and their significance. In general, however, these differences should not be significant. Each offeror proposes to accomplish the same objectives with generally similar designs, risks and the like. However, there could be instances of significant difference in approach or in other factors which could have significantly different Government cost uncertainties. For example, the Government may want a helicopter exhibiting certain characteristics; one offeror may propose an essentially new helicopter and another offeror may propose a modified version of a model he already produces. Presumably, the Government estimate would be less uncertain for the latter offeror. Application of the same scoring rule to both offers could result in identical scores, even though the likelihood that their offers would match the Government estimate differs greatly. The cost evaluation team should be aware of these possibilities and try to assure that the scoring process does not penalize offerors unjustly. If it can be anticipated that proposals with approaches subject to very different cost uncertainties will be received, then a cost evaluation approach can be developed and prospective offerors notified in the solicitation that the evaluation methods will differ depending upon certain factors (e.g., new or modified hardware). If the problem only becomes apparent after proposals are received, then modified evaluation methods could be announced to the offerors before receipt of their best-and-final offers.

c.) A computer model has been developed for calculating scores and is described in Appendix F.

Rationalizing Numerical Scoring

As stated in the beginning of this section, numerical scoring of costs is discouraged by some Defense organizations. The main objection appears to be that an inflexible scoring and

weighting system will force an irrational decision based on an inflexible scoring and weighting system.

The advantage of numerical scoring is that comparisons are more structured and less arbitrary. And, there are several means available to avoid or lessen the chances of being driven to an irrational decision. These include:

a.) Careful selection of scoring rules and weights with the help of sensitivity and tradeoff analyses (as discussed in the next section) can minimize any problems and surprises.

b.) The SSA generally has enough flexibility, if he chooses to exercise it, to make an award to the best offeror, all things considered, even if there is a numerical scoring system. Obviously, if the numerical scoring system appears to lead to a bad decision, the SSA must be able to support any decision to disregard it.

c.) If the numerical scoring system is driving toward an irrational decision, the SSA can issue a revision to the solicitation prior to the best-and-final offer. The revision can state that the evaluation criteria have been revised (without, of course, revealing the precise criteria and scoring system).

d.) The SSA can recompet.

e.) Cost scores can be developed and provided to the SSA as advisory information without incorporating them into an overall numerical score (as discussed in the beginning of this section).

D. EVALUATION METHODOLOGY SUMMARY

There are several alternatives for evaluating Government estimated cost and cost realism. Narrative, tabular and graphical displays can be used without any rating or scoring or as information which supplements qualitative ratings or numerical scores.

Qualitative ratings may be used by assigning an adjective or color rating or grade for each offeror. Numerical scoring may be used by developing a realistic Government cost estimate for each of the offerors and using triangle, trapezoid or normal

curve scoring rules. The methodology for numerical scoring is summarized below.

The Government estimated cost score is a function of the difference between the Government estimate for each offeror (G) and the lowest Government estimate for any offeror (G*) expressed in percentage terms as:

$$\text{Score (GE)} = f \left(\frac{G - G^*}{G^*} \% \right) = f(D)$$

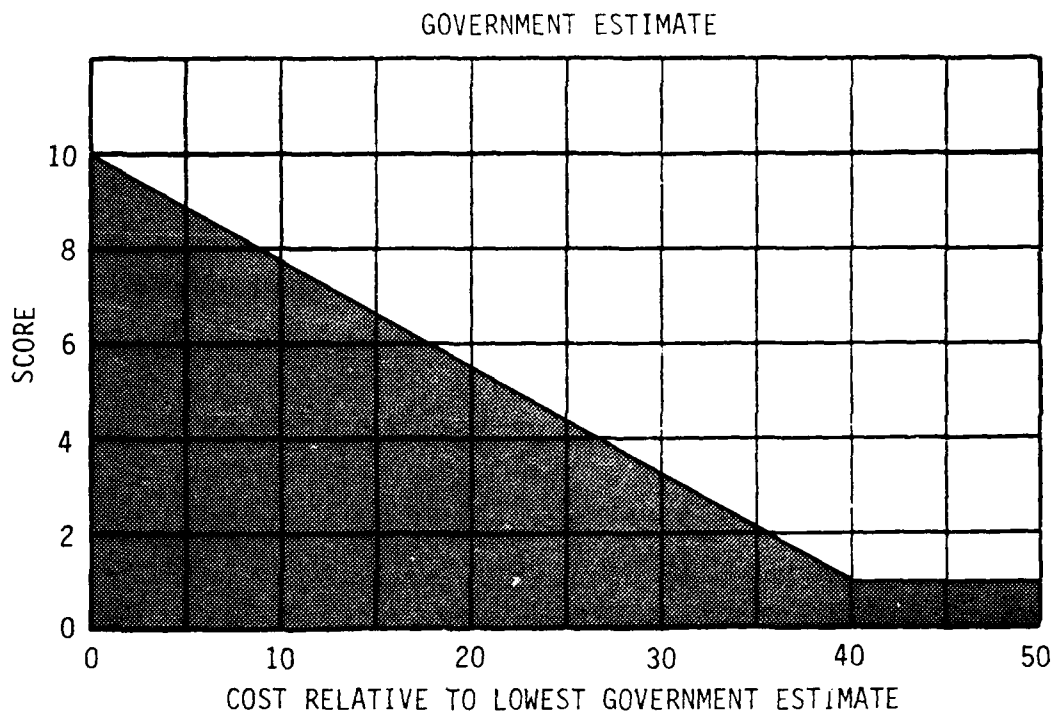
The cost realism score is a function of the difference between the offer (C) and the Government estimate (G) expressed in percentage terms as:

$$\text{Score (CR)} = f \left(\left| \frac{C - G}{G} \right| \% \right) = f(D')$$

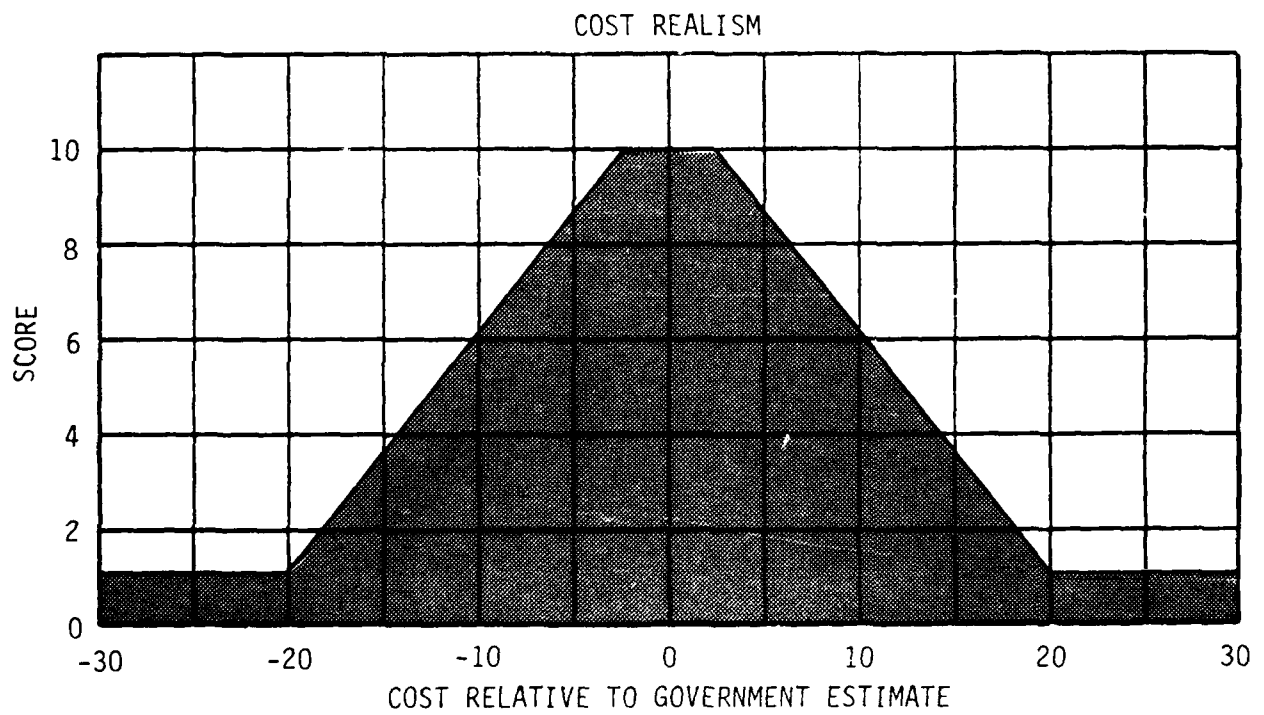
The scoring rules are shown in Figure 8.4. For illustrative purposes, the maximum scores are shown as 10 and the minimum scores as 1. For the Government estimated cost scoring rule, a spread of 40 percent is illustrated. For the cost realism scoring rule, a spread of 20 percent is illustrated, and a "plateau" (where the score is a maximum) of 10 percent of the spread or plus or minus 2 percent of the Government estimate is illustrated. Generally, the Government estimated cost spread would be 30 to 50 percent, and the cost realism spread would be 15 to 25 percent. Normal curve scoring rules are discussed in Appendix E.

In determining values for the spreads for any source selection, the cost evaluation team should analyze the effects of different values of the spreads on the cost score and the overall score. This should include a determination of the reasonableness of the tradeoffs between cost and technical scores and between Government estimated cost and cost realism scores as discussed in Section IX. The actual values established for the spreads will of course be a subjective determination.

In addition to providing the SSA with a qualitative rating or numerical score, a tabular and even a graphical presentation of C, G, (C-G)/G, and (G-G*)/G* should be presented. Further-



$$\frac{G-G^*}{G^*} \% = \text{Delta}$$



$$\frac{C-G_m}{G} \% = \text{Delta'}$$

Figure 8.4. Scoring Rules

more, the SSA should be provided with a narrative evaluation of Government estimated cost and cost realism.

Methodology: Rate or score Government estimated cost and cost realism for each contractor. If qualitative rating is used, apply a rating or grade (e.g., an adjective) for each cost evaluation sub-criteria. If numerical scoring is used, apply a triangle, trapezoid or normal curve scoring rule. The Government estimated cost score is a function of the difference between the Government estimate for each offeror and the lowest Government estimate for any offeror. The cost realism score is a function of the difference between the offer and the Government estimate. The differences corresponding to a minimum score (triangle or trapezoid) or to a 95 percent likelihood (normal curve) should be determined for each procurement based on sensitivity and tradeoff analyses. Also prepare a tabular, and possibly graphical, presentation of the a) offers, b) Government estimates, c) percent differences between the Government estimates and the lowest Government estimate, and d) percent differences between the offers and the Government estimates. In addition, prepare a narrative cost evaluation.

SECTION IX

SENSITIVITY AND TRADEOFF ANALYSES

It was stressed in the numerical scoring discussion in the previous section that cost evaluation scoring rules and weights must be carefully selected in order to minimize any problems and surprises. Selecting the appropriate scoring rule is primarily a matter of determining an appropriate spread. This section addresses two methods for helped to determine appropriate scoring rule spreads and weights--sensitivity analyses and tradeoff analyses.

A. SENSITIVITY ANALYSES

Sensitivity analyses involve varying the spread and/or weight and calculating the affect of these variations on the numerical score. An example of varying the Government estimated cost spread from 30 to 50 percent is shown in Figure 9.1 for five hypothetical offerors (A to E). The offers and corresponding Government estimates for these hypothetical offerors are the same as those used in the illustrative example in Section X. Sensitivity analyses give some idea of the affect of spreads and weights on scores and therefore may be of some help in determining appropriate spreads and weights. A computer model has been developed for calculating scores and conducting sensitivity analyses and is described in Appendix F, Cost Realism Computer Models. Illustrative sensitivity analyses are provided for a broad range of values for the spreads and weights.

Sensitivity analyses may also be used for the purpose of understanding the effects of uncertainty in the Government estimate on the cost realism scores as mentioned in the uncertainty discussion in Section VIII.

B. TRADEOFF ANALYSES

Tradeoff analyses involve trading off technical and Government estimated cost, technical and cost realism, or Government estimated cost and cost realism. For example, if one offeror

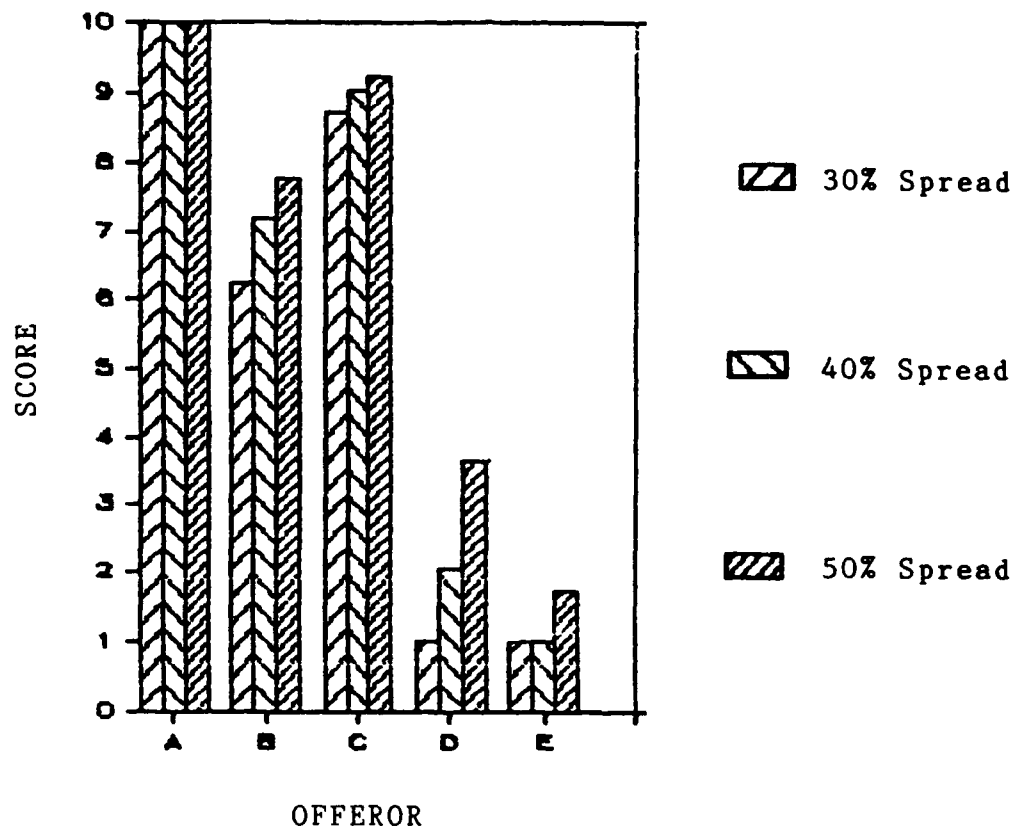


Figure 9.1 Sensitivity Analysis

has a technical score 10 percent greater than that for another offeror, how much lower would his Government estimated cost score have to be to offset his technical advantage. The answer can be determined from the spread and weight for the Government estimated cost and the technical weight. If the answer, i.e. the trade, is not reasonable, then the scoring rule spread or the weights can be adjusted.

Tradeoffs are illustrated in Figure 9.2. The following weights and spreads are assumed:

Evaluation Criteria	Weight	Spread	Shape
Technical	60%		
Cost	30%		
Gov't Estimate	(20%)	40%	Triangle
Cost Realism	(10%)	20%	Trapezoid
Other	10%		
Total	100%		

It is also assumed that an offeror A is technically superior to an offeror B by 10 percent--a technical score of 60 for A and 54.5 for B, out of a possible 60. For the Government estimated cost versus technical tradeoff, offeror A's 5.5 point advantage in technical score would be offset if his Government estimated cost score is 5.5 points less than B's. A Government estimated cost score of 14.5 out of a possible 20 (7.3 on a scale of 10) corresponds to a Delta $((G-G^*)/G)$ of 12 percent. Offeror B is assumed to have a Delta of zero. Thus, offeror A would lose his advantage in technical score if his Government estimated cost were 12 percent or more higher than B's. Similarly, for the cost realism versus technical tradeoff, offeror A's advantage in technical score would be offset if his cost realism score is 5.5 points less than B's. A cost realism score of 4.5 out of a possible 10 corresponds to a Delta' $((C-G)/G)$ of 13 percent. Offeror B is assumed to have a Delta of zero.

CRITERIA	MAXIMUM SCORE	GOVERNMENT ESTIMATE VS. TECHNICAL		COST REALISM VS. TECHNICAL	
		OFFEROR A	OFFEROR B	OFFEROR A	OFFEROR B
OTHER	10				
COST REALISM	10	10	10	10	10
GOVERNMENT ESTIMATE	20	10	10	4.5	10
		14.5	20	20	20
TECHNICAL	60				
		60	54.5	60	54.5
TOTAL POINTS	100	94.5	94.5	94.5	94.5

Figure 9.2. Cost/Technical Tradeoffs Example

These tradeoffs may be summarized as follows: an offeror A who is technically superior to an offeror B by 10 percent would receive the same overall score as offeror B, if: (1) offeror A's Government estimated cost was 12 percent greater than offeror B's Government estimated cost (assumed as the lowest Government estimate), or (2) B's offer matches the Government estimate and A's offer differs from the Government estimate by 13 percent. Note that the cost criterion not being traded off is assumed to receive the maximum score. Also note that there is a tradeoff implied between Government estimated cost and cost realism--namely that a Government estimated cost advantage of 12 percent would be offset by a cost realism difference of 13 percent.

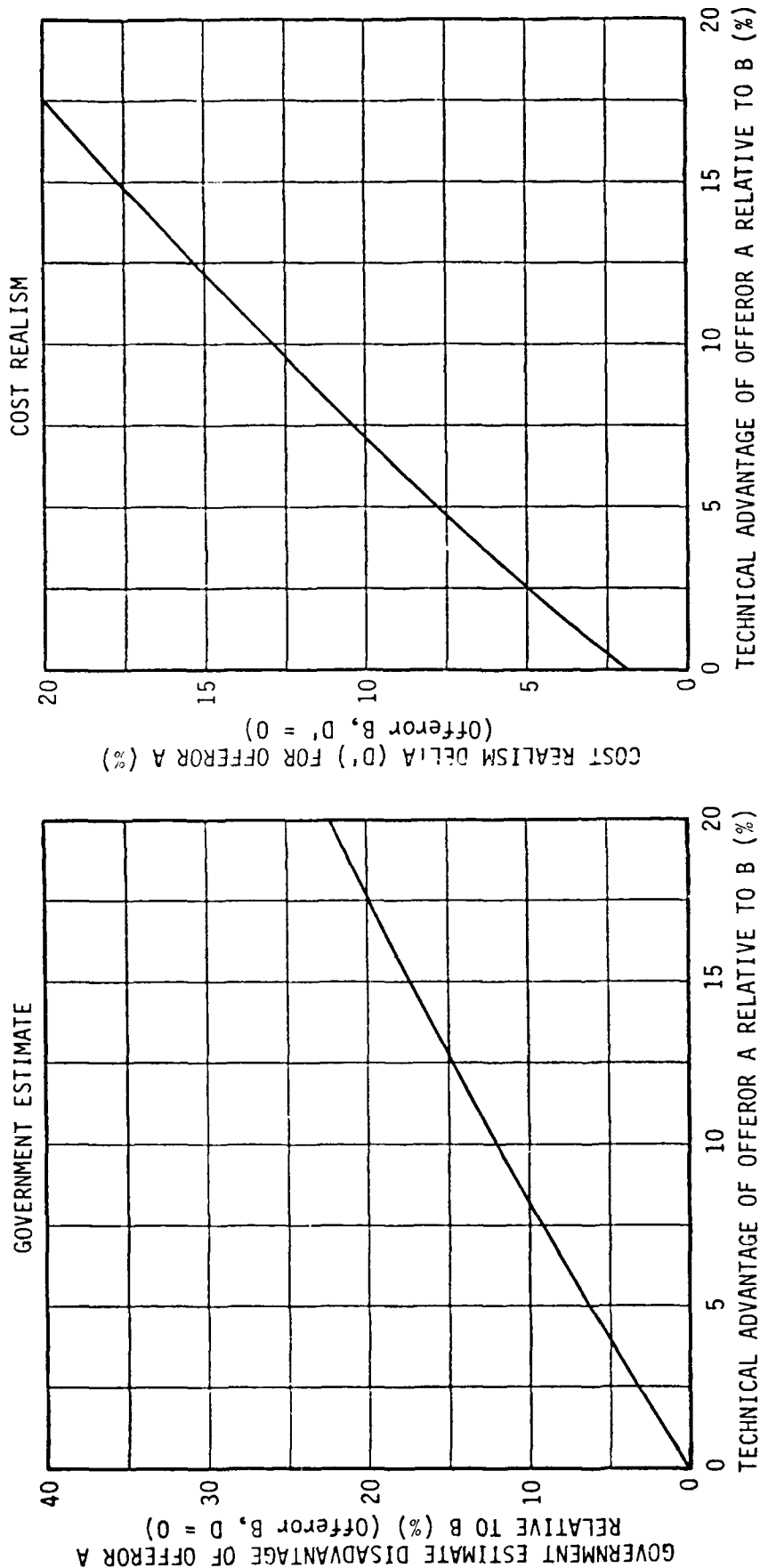
By calculating the tradeoffs for a number of values of technical advantage, tradeoff curves can be generated. This is illustrated in Figure 9.3, which plots technical advantage as a function of offsetting cost disadvantage and also plots technical advantage as a function of offsetting cost realism delta. The same spreads and weights as in the above example are assumed. The tradeoff curve for Government estimated cost and cost realism is illustrated in Figure 9.4.

It should be noted that since the scoring rules and weights must be established before the solicitation is issued, appropriate analyses and tradeoffs must also be done before the solicitation is issued.

An approach to conducting the cost and technical tradeoffs is discussed next. This approach is based on developing "indifference envelopes" and is discussed first for Government estimated cost and then for cost realism.

Government Estimated Cost Indifference Envelope

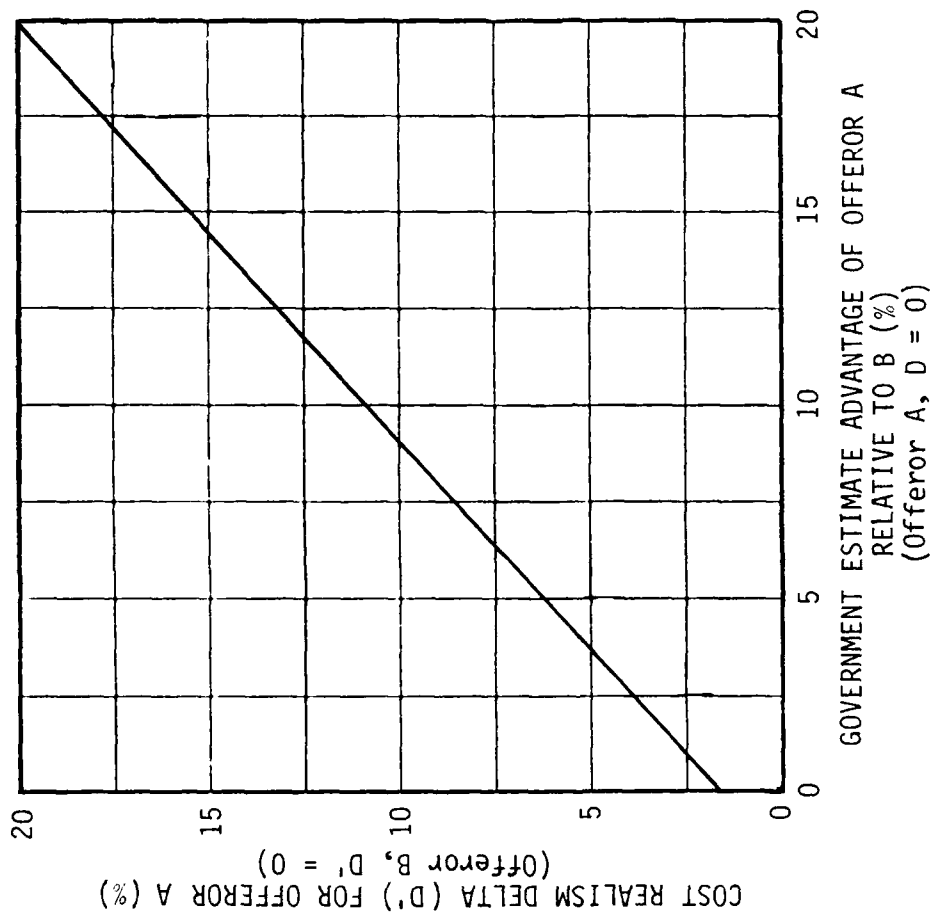
An important issue facing the cost evaluation team is how much should the Government be willing to pay for technical superiority? For example, if offeror A is 10 percent technically better than B, should the Government pay 10 percent more? Should they pay 20 percent more? Answers to questions of this type can be used to develop "indifference envelopes"--the



Assumptions: Technical/Cost/Other Weights (%)--60/30/10
 Government Estimate/Cost Realism Weights (%)--67/33
 Spreads--Government Estimate = 40%, Cost Realism = 20%

Example: Offeror A Can Trade Off a 10% Technical Advantage for 12% Government Estimate Disadvantage

Figure 9.3. Cost and Technical Tradeoff Graphs

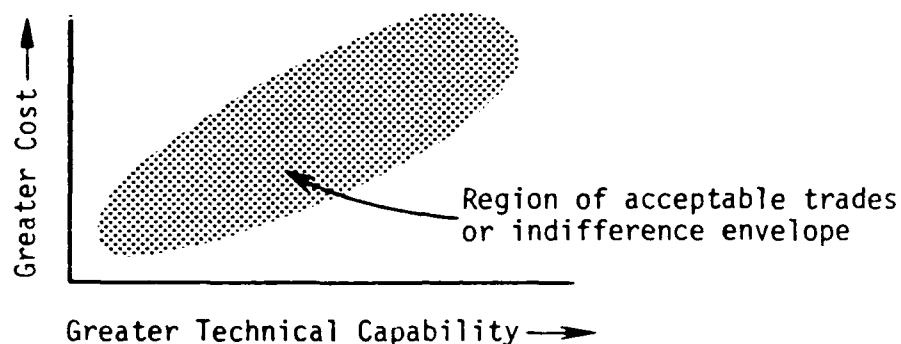


Assumptions: Same as Figure 9.3

Example: Offeror A can trade off a 10% Government estimate advantage for 11% cost realism disadvantage.

Figure 9.4. Government Estimate and Cost Realism Tradeoff Graph

combinations of technical capability/competence and cost for which the cost evaluation team and the technical evaluation team (which will be referred to as evaluation teams) would be indifferent or uncertain as to which contractor should receive the award. This concept is illustrated below.



To construct an indifference envelope for any particular source selection, the cost evaluation team should try to answer the following questions. Given that offeror A has a certain technical advantage over B (A has a technical score X percent higher than B), then:

- Up to what additional cost should the Government almost certainly be willing to pay A relative to B for A's technical advantage?
- Beyond what additional cost should the Government almost certainly prefer to award to B, despite A's technical advantage?

Generally, the answers to these two questions will not be the same because there will be a range of costs which the evaluation teams will be indifferent about or uncertain as to whether to award to offeror A or B. Therefore, answers to these questions can be used to establish lower and upper bounds, respectively, for an "indifference envelope". For example, if offeror A has a 10 percent technical advantage over B, the evaluation teams may prefer to award the contract to A even if A has up to a 7 to 8 percent cost disadvantage. However, if A has a 17 percent or more cost disadvantage, they may prefer to award the contract to offeror B. In between, they may be indifferent or uncertain as to which offeror to prefer. For other degrees of technical

advantage, the evaluation teams would make similar determinations.

An example of an indifference envelope that has some plausibility is shown in Figure 9.5. Below the envelope, offeror A is generally favored and, above the envelope, B is generally favored. If the lower bound is placed too low, offeror A could lose even though they are very superior technically at relatively little added cost (e.g., 20 percent better technically at only 10 percent higher cost, but offeror A loses). If the upper bound is placed too high, offeror A could win even though the price for being very superior is rather high (e.g., 20 percent better technically, but 40 percent higher in cost, yet offeror A still wins). In sum, technical superiority should be rewarded but not at too high a price.

The cost evaluation teams can use the indifference envelope, which represents the evaluation teams best estimate of acceptable technical and Government estimated cost tradeoffs, to determine the Government estimated cost criterion weighting in the following way. Government estimated cost and technical tradeoff curves like those shown earlier in Figure 9.3 can be developed for several different Government estimated cost weights. The weights can be conveniently expressed in terms of the ratio of the weight for the Government estimated cost score to the weight for the technical score. For example, a Government estimated cost weight of 20 percent and a technical weight of 60 percent results in a ratio (W) equal to 0.33. The tradeoff curves for several values of W can then be superimposed on the graph of the indifference envelope. This is illustrated in Figure 9.6. An acceptable weighting would be one where the tradeoff curve falls well within the indifference envelope as, for example, the tradeoff curve based on $W = 0.33$ shown in Figure 9.6.

The picture presented by Figure 9.6 is simplified since the tradeoff curves were computed assuming first that offeror A has the highest possible technical score (e.g., 60 points out of a possible 60 points) and second that offeror B has the highest

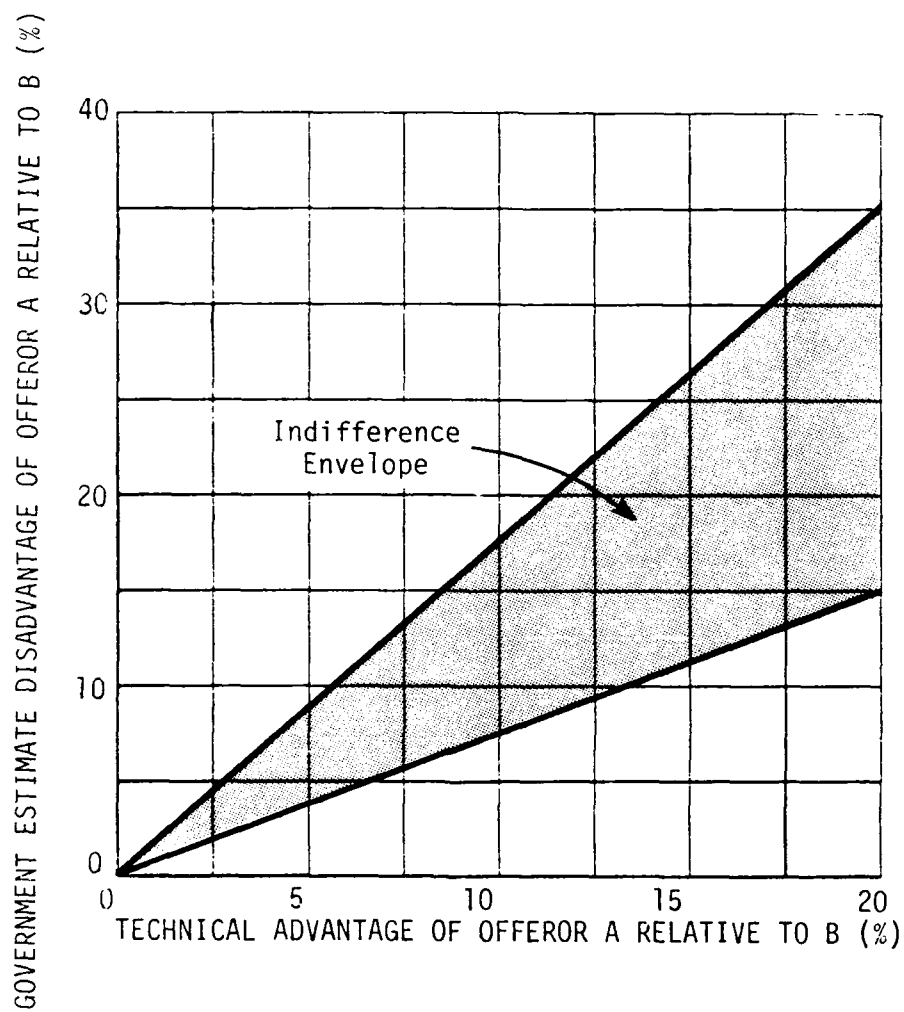
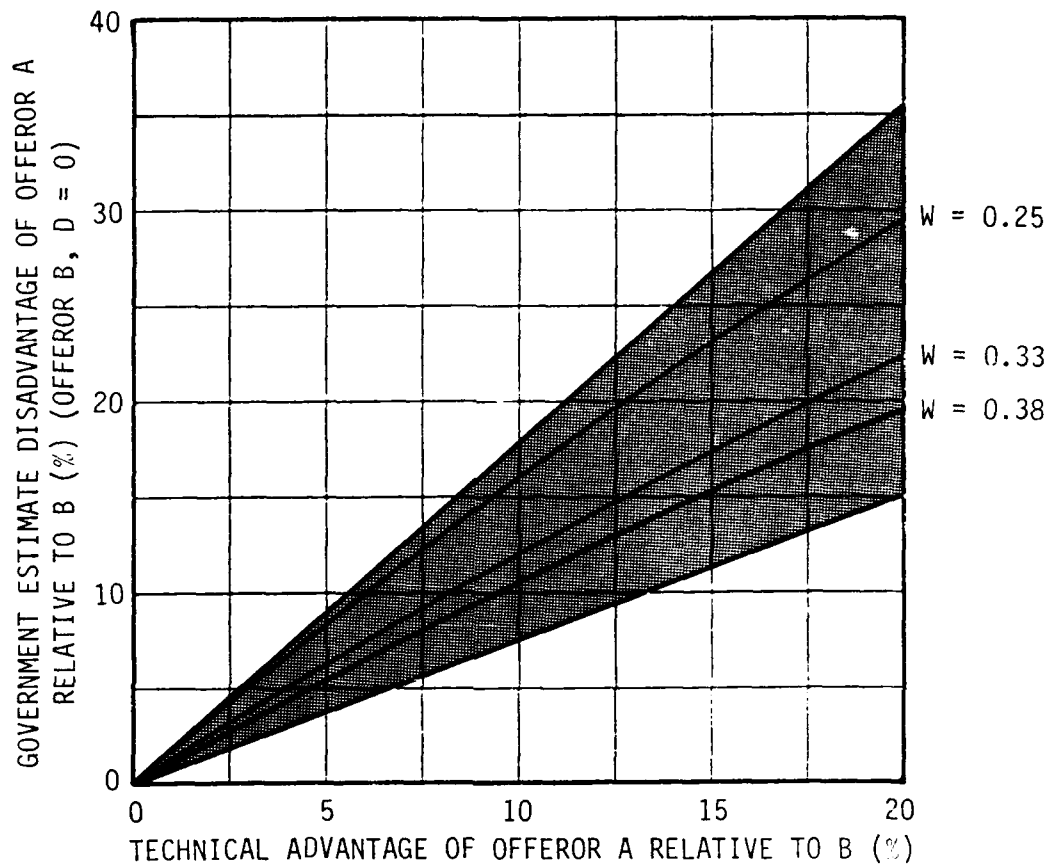


Figure 9.5 Government Estimated Cost Indifference Envelope



Note: W is the ratio of the Government estimated cost weight to the technical score. Offeror A is assumed to receive a maximum technical score, and Offeror B is assumed to receive a maximum Government estimated cost score.

Figure 9.6. Government Estimated Cost Indifference Envelope/Tradeoff Graph

possible Government estimated cost score, i.e., B's Government estimated cost is the lowest Government estimate cost ($\Delta = 0$) giving a maximum score of 10. These are the baseline assumptions. Assuming that B's technical score is not likely to be less than 70 percent of the maximum possible score (for example, 70 percent might represent a point below which an offeror should be disqualified), a lower bound tradeoff curve can be computed as shown in Figure 9.7. Assuming that B's Δ is no more than 5 percent (i.e., there is an offeror C whose Government estimated cost is as much as 5 percent less than B's), a tradeoff curve which falls between the baseline and lower bound can be computed as shown in Figure 9.7. Thus, the tradeoff for a particular W becomes a band rather than a line.

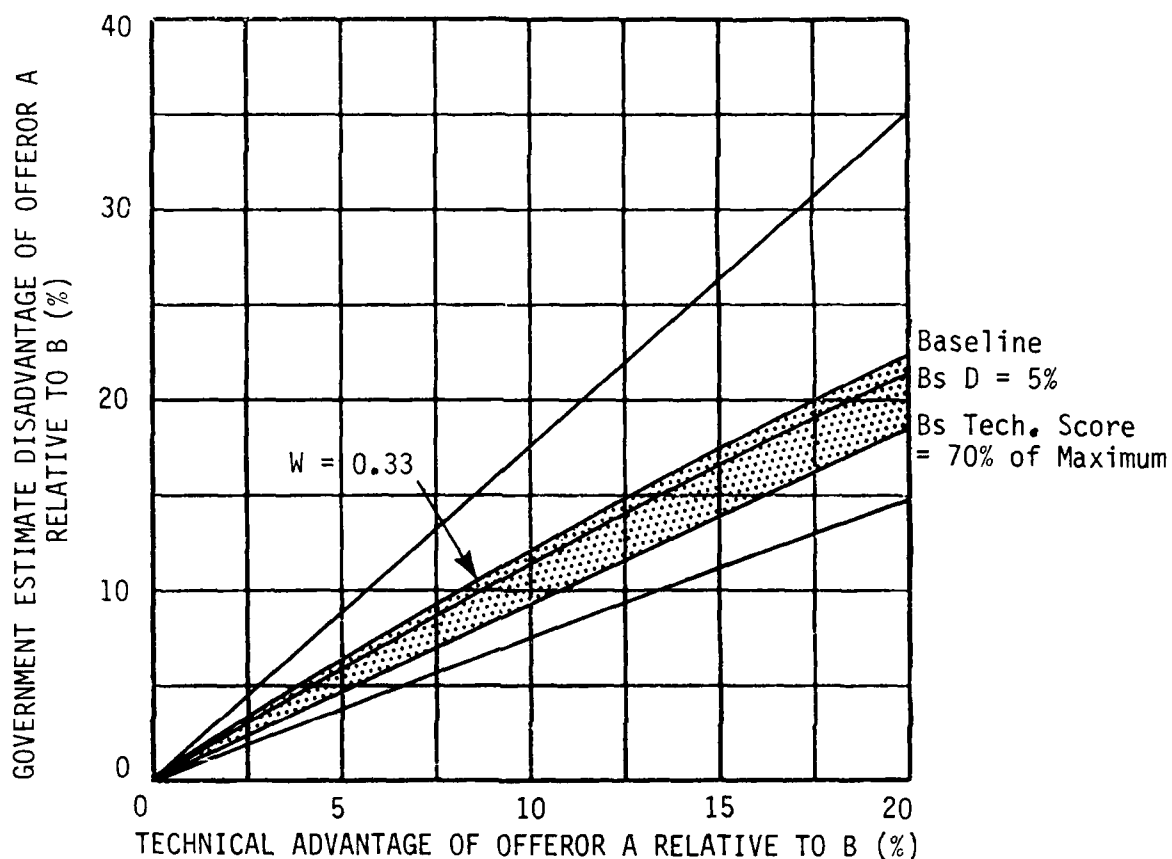
Cost Realism Indifference Envelope

Another important issue facing the cost evaluation team is, given that an offeror is technically superior, should the Government be concerned if the offeror is unrealistic? For example, if offeror A is 10 percent technically better than B, should the Government be concerned that offeror A is unrealistic by a factor of 10 percent when compared to the Government estimate? Should they be concerned if A is unrealistic by 20 percent? Answers to questions of this type can be used by the evaluation teams to develop "indifference envelopes" in the same manner as discussed for Government estimated cost.

To construct an indifference envelope, the evaluation teams should try to answer the following questions. Given that offeror A has a certain technical advantage over B (A has a technical score X percent higher than B), then:

- Up to what degree of unrealism in A's offer would the Government almost certainly accept and still award the contract to A?
- Beyond what degree of unrealism in A's offer would the Government almost certainly prefer to award to B?

Answers to these questions can be used to establish lower and upper bounds, respectively, for an indifference envelope. For example, if offeror A has a 10 percent technical advantage over



Note: The shaded area represents a Government estimated cost weight to technical weight ratio of $W = 0.33$. The top line assumes a maximum technical score for A and $D = 0$ for B, as in the previous figure. The middle line assumes $D = 0$ for B, and the bottom line assumes 70% of maximum technical score for B and $D = 0$ for B.

Figure 9.7 Government Estimated Cost Tradeoff Band

B, the evaluation teams may prefer to award the contract to A even if A is 7 to 8 percent unrealistic. However, if A is more than 17 percent unrealistic, they may prefer to award to offeror B.

An example of an indifference envelope that has some plausibility is shown in Figure 9.8. Below the envelope, offeror A is generally favored and above the envelope, offeror B is generally favored. If the lower bound is placed too low, offeror A could lose even though technically they are very superior with only a slightly unrealistic offer. If the upper bound is placed too high, offeror A could win even though their offer is judged to be very unrealistic.

The cost evaluation team can use the indifference envelope to determine the cost realism criterion weighting in the same manner as discussed for Government estimated cost. Tradeoff curves can be superimposed on the graph of the indifference envelope as illustrated in Figure 9.9. An acceptable weighting would be one where the tradeoff curve falls well within the indifference envelope as, for example, the tradeoff curve based on $W = 0.17$ as shown in Figure 9.9. In this case, W is the ratio of the weight for the cost realism score (10) to the weight for the technical score (60).

The picture presented by Figure 9.9 is simplified since the tradeoff curves were computed assuming that offeror A has the highest possible technical score and that offeror B has the highest possible cost realism score. Assuming that B's technical score is at least 70 percent of the maximum possible score and that B's cost realism delta (Δ') is no more than 5 percent, a tradeoff curve band can be computed as shown in Figure 9.10.

Government Estimate/Cost Realism Indifference Envelope

The above discussion of tradeoffs has focused on cost and technical tradeoffs. The tradeoff between Government estimated cost and cost realism was not explicitly considered. However in establishing the indifference curves for Government estimated

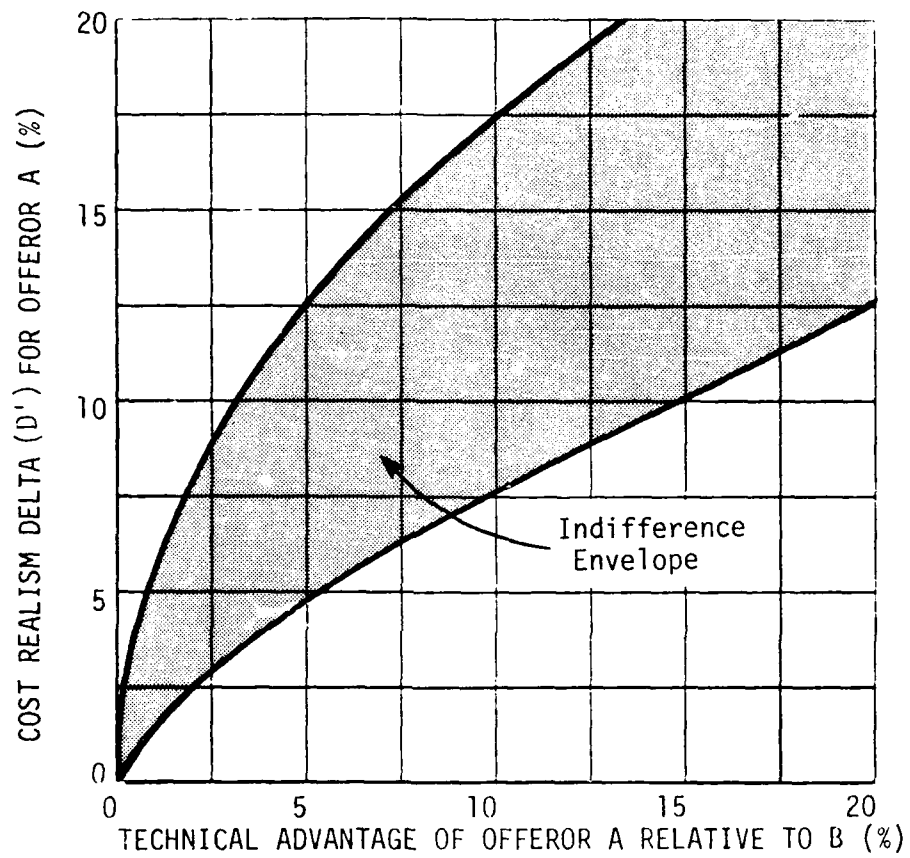
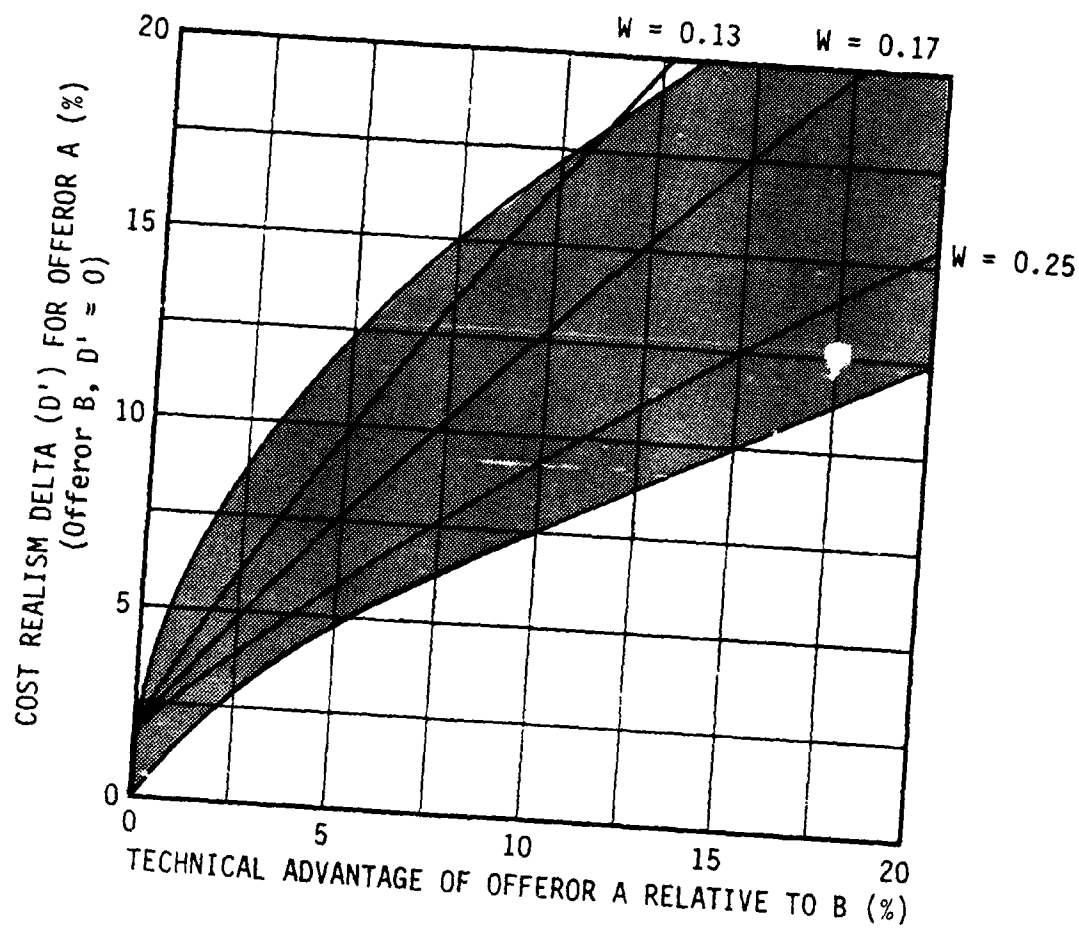
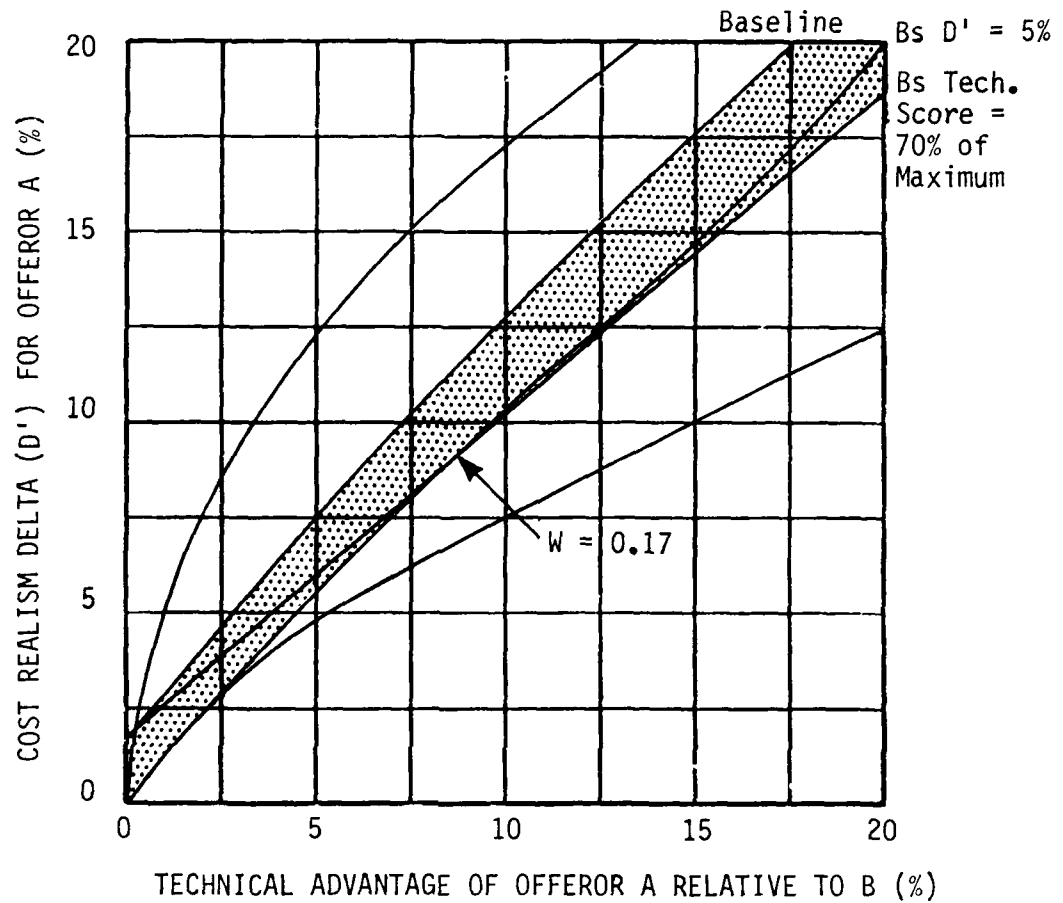


Figure 9.8 Cost Realism Indifference Envelope



Notes: W is the ratio of the cost realism weight to the technical weight. Offeror A is assumed to have a maximum technical score, and Offeror B is assumed to receive a maximum cost realism score.

Figure 9.9. Cost Realism Indifference Envelope/Tradeoff Graph



Notes: The shaded area represents a cost realism weight to technical weight ratio of $W=0.17$. The top line assumes a maximum technical score for A and $D'=0$ for B, as in the previous figure. The other lines assume $D=5\%$ for B and assume 70% of the maximum technical score for B and $D'=0$ for B.

Figure 9.10 Cost Realism Tradeoff Band

cost and cost realism as a function of technical advantage, there was an implicit tradeoff between Government estimated cost and cost realism. This tradeoff between Government estimated cost and cost realism should be made explicit and checked for reasonableness.

Indifference envelopes can be developed in the same manner as discussed above for Government estimated cost and cost realism. The evaluation teams should try to answer the following questions. Given that offeror A has a certain Government estimated cost advantage over B (e.g., A's Government estimated cost score is 10 percent higher than B's), then:

- Up to what degree of unrealism in A's offer would the Government almost certainly accept and still award the contract to A?
- Beyond what degree of unrealism in A's offer would the Government almost certainly prefer to award to B?

Answers to these questions can be used to establish lower and upper bounds, respectively, for an indifference envelope. For example, if offeror A has a 10 percent estimated cost advantage over B, the evaluation teams may clearly prefer to award the contract to A even if A is 9 percent unrealistic. However, if A is more than 13 percent unrealistic, they may clearly prefer to award to offeror B.

An indifference envelope may also be determined from the Government estimated cost and cost realism indifference envelopes. For example, if for a technical advantage of 15 percent, the Government estimated cost indifference envelope lower bound is 11 percent and the cost realism lower bound is 15 percent, then these values are one point on the Government estimate/cost realism indifference envelope lower bound.

An indifference envelope is shown in Figure 9.11 based on the Government estimate and cost realism envelopes shown in Figure 9.5 and 9.8. Below the envelope, offeror A is generally favored and above the envelope, offeror B is generally favored. If the lower bound is placed too low, offeror A could lose even though they have a significant cost advantage and only a slightly unrealistic offer. If the upper bound is placed too

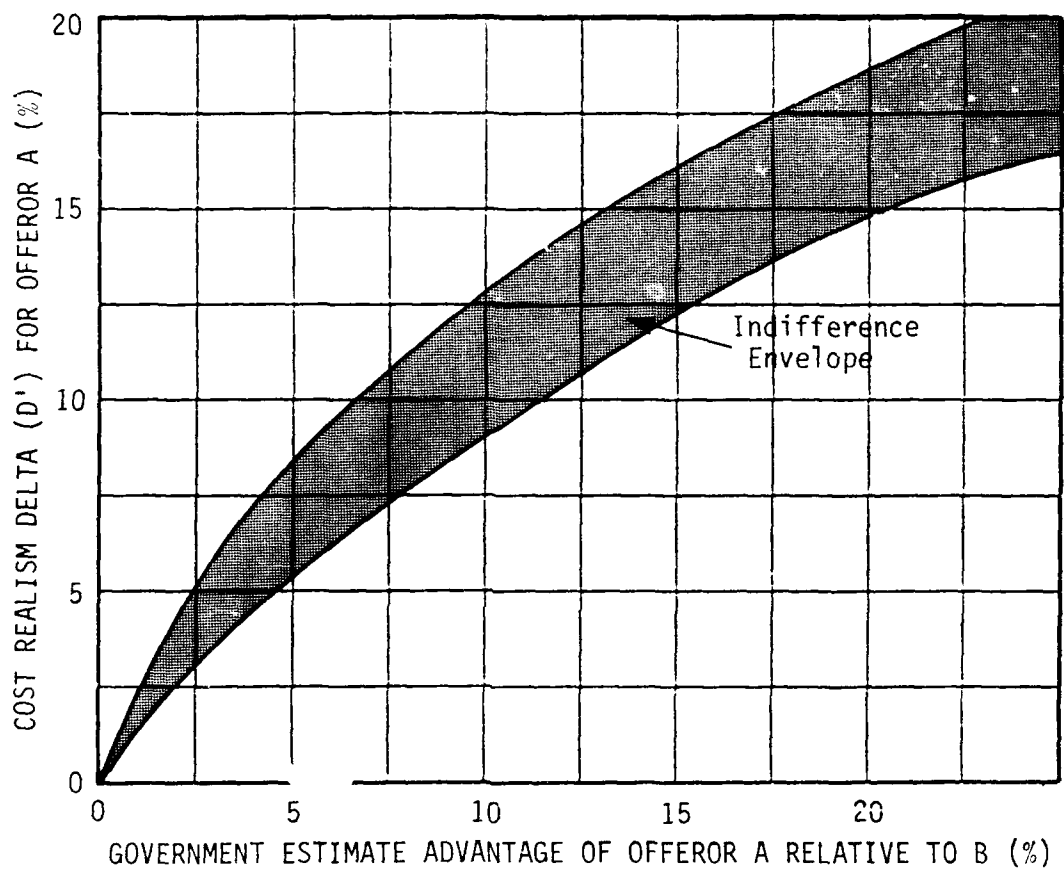
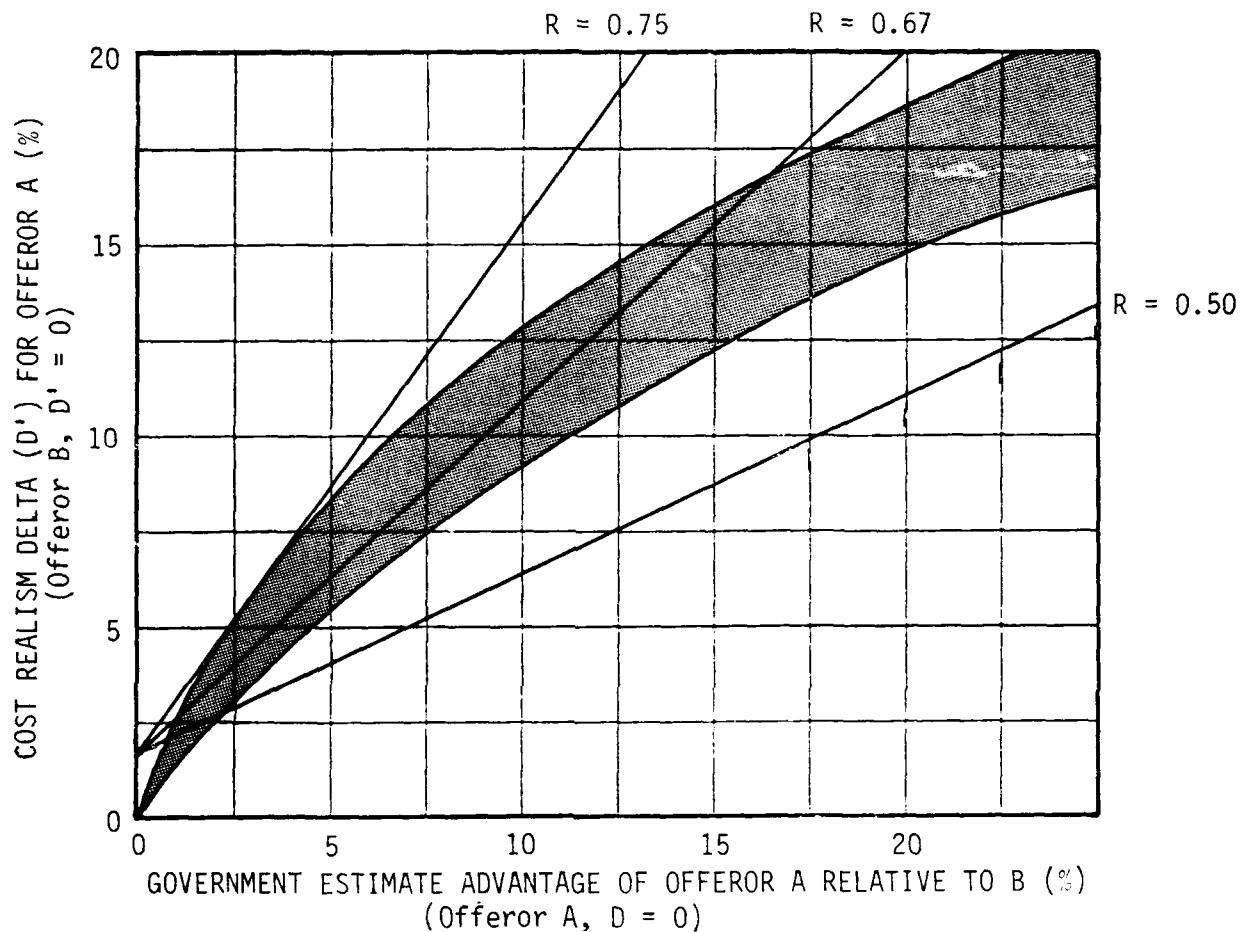


Figure 9.11. Government Estimate/Cost Realism Indifference Envelope

high, offeror A could win even though their offer is judged to be very unrealistic.

The cost evaluation team can use the indifference envelope to determine the relative weights of Government estimated cost and cost realism in the same manner as discussed for Government estimated cost and cost realism. Tradeoff curves can be superimposed on the graph of the indifference envelope as illustrated in Figure 9.12. An acceptable weighting would be one where the tradeoff curve falls well within the indifference envelope as, for example, the tradeoff curve based on $R = 0.67$ as shown in Figure 9.12. In this case, R is the ratio of the weight for the Government estimated cost score to the sum of the weights for the Government estimated cost score and the cost realism score. For example, a Government estimate cost weight of 20 percent out of a combined Government estimate cost and cost realism weight of 30 percent gives a ratio of 0.67. The tradeoff curves in Figure 9.12 assume a Government estimated cost spread twice the cost realism spread, e.g., 40 and 20 percent spreads, respectively. (The picture presented by Figure 9.12 is simplified since the tradeoff curves were computed assuming that offeror A has the highest possible technical score and that offeror B has the highest possible cost realism score.)

The tradeoff curves in Figure 9.12 may be interpreted as follows. For $R = 0.50$ (equal weighting of Government estimated cost and cost realism), offeror B would win over offeror A if B's cost was 10 percent higher than A's, but A was unrealistic by 6 percent or more. For $R = 0.67$, B would win if B's cost was 10 percent higher but A was unrealistic by 11 percent or more. For $R = 0.75$, B would win if B's cost was 10 percent higher but A was unrealistic by 16 percent or more. The trades suggested by the curve with $R = 0.50$ does not seem reasonable. For example, it suggests that the Government would pay 20 percent more rather than accept an offer which was unrealistic by more than 9 percent. The other two tradeoff curves which weight Government estimated cost significantly higher than cost realism do seem reasonable. The cost evaluation team and SSA must



Note: R is the ratio of the Government estimated cost weight to the sum of the Government estimated cost and cost realism weights

Figure 9.12. Government Estimate/Cost Realism Indifference Envelope/Tradeoff Graph

develop tradeoff curves like these and decide which weight ratio is reasonable.

Combined Weights

Appropriate weights for Government estimated cost and cost realism can be determined as described above. Once these weights are determined they should be summed to determine whether they add to an appropriate total weight for the cost evaluation (assuming that DTUPC and LCC evaluation criteria are not included in the cost evaluation). For example, based on Figures 9.6 and 9.9, W's for Government estimated cost and cost realism of 0.33 and 0.17, respectively, appeared to be appropriate. These values sum to 0.50. If technical is weighted 60 percent, this suggests that the cost evaluation weight would be 30 percent (i.e., 0.50×60). If the overall cost evaluation weight is not appropriate then the Government estimated cost and cost realism weights can be adjusted to some extent, especially since their selection is somewhat arbitrary. Also, if necessary the Government estimated cost and cost realism spreads can be adjusted to some extent, since their selection is also somewhat arbitrary.

A computer model has been developed for generating tradeoff curves and is described in Appendix F, Cost Realism Computer Models. Illustrative tradeoff curves are provided for a broad range of values for the spreads and weights.

SECTION X

ILLUSTRATIVE EXAMPLE

This section provides an illustrative example of how to apply the cost evaluation methodology presented in the preceding sections. A full scale development, cost reimburseable competition is assumed. Technical, schedule and cost risk are assumed to be medium. The hypothetical activities that would be followed by a cost evaluation team, along with the SSA and others in the source selection organization (collectively referred to as the SSA), are presented below. These activities begin with preparation of the source selection plan and continue through proposal evaluation and award.

A. SOURCE SELECTION PLAN

First, as part of the source selection plan preparation, the cost evaluation team and SSA should decide what factors to include in the cost evaluation. As recommended in Section V, both cost realism as well as Government estimated cost should be included as explicit cost evaluation sub-criteria. For this example, it is assumed that it is decided not to include DTUPC or LCC as explicit evaluation sub-criteria because they are judged to be of lesser importance, the expense (both contractor and Government) to prepare and evaluate them accurately appears to outweigh the benefits, and they would tend to "water down" the importance of the Government estimated cost and cost realism criteria.*

Next, the cost evaluation team and SSA should establish the scoring rules to be used for Government estimated cost and cost realism. The three major decisions are: (1) the type of scoring rule (e.g., trapezoid or normal curve) (2) the spread of the scoring rule; and (3) the sub-criteria weights.

* The cost evaluation team may still want to suggest in the solicitation that the offerors discuss their DTUPC and/or LCC programs and how they intend to meet their cost goals.

The triangle and the trapezoid scoring rules are used for Government estimated cost and cost realism, respectively, for the reasons discussed in Section VIII.

The spreads of the Government estimated cost and cost realism scoring rules should be determined primarily on the basis of assuring that there is sufficient differentiation among offerors. Consideration should also be given to the potential uncertainties in the Government estimates, and the cost realism scoring rule spread should be at least as great as these uncertainties*.

For Government estimated cost, a spread of 30 to 40 percent was suggested in Section VIII as reasonable considering some data on past cost evaluations. The differentiation of scores for different spreads can be considered by examining the table on page 8-11. For spreads that are either very high or very low, there is not a reasonable differentiation of scores. Based on this consideration, as well as the likelihood that a Government estimated cost more than 40 percent above the lowest Government estimate would be unacceptable, a spread of 40 percent is selected.

For cost realism, a spread of 15 to 25 percent was suggested in Section VIII as reasonable considering some data on past cost evaluations and the likely uncertainty in the Government estimates.** Based upon a consideration of the differentiation of scores for different spreads, the fact that the program is medium risk, and the fact that offers greater than 20 percent from a carefully prepared Government estimate would certainly raise a serious question of cost realism, a spread of 20 percent is selected.

The weights for the Government estimated cost and cost realism criteria may be best determined by first developing

* As discussed in Section VIII, unless the spread in the uncertainty distribution about the Government estimate is greater than the spread in the scoring rule, there is no need to determine the uncertainty for cost realism cost scoring.

** For this illustration, the uncertainty spread is assumed to be small and less than the scoring rule spread.

indifference envelopes as discussed in Section IX. The cost evaluation team should develop indifference envelopes by considering the various tradeoffs between Government estimated cost, cost realism, and technical capability for two hypothetical offerors (A and B). It is assumed that the cost evaluation team with the assistance of the technical evaluation team and the SSA develops indifference envelopes like those shown in Figures 9.5, 9.8 and 9.11. The cost evaluation team should next develop cost and technical tradeoff curves and superimpose them on the indifference envelope graphs. It is assumed that the cost evaluation team develops graphs like those shown in Figures 9.6, 9.9 and 9.12 and that they and the SSA conclude that the weight for Government estimated cost should be 0.33 times the technical weight and the weight for cost realism should be 0.17 times the technical weight. Therefore, Government estimated cost is weighted twice as heavily as cost realism. It is further assumed that they and the SSA have decided that the technical evaluation weight should be 60 percent of the total evaluation score and that the total cost evaluation weight should be 30 percent. Thus, Government estimated cost will receive 20 percent of the total evaluation score and cost realism 10 percent. These sum to 30 percent which is the same as the total cost evaluation weight already decided upon. If the sum had been different, the Government estimated cost and cost realism weights and the scoring rule spreads could be adjusted.

Also during this early phase of the source selection, it is assumed that the cost evaluation team develops an independent cost estimate of the system to indicate areas the WBS should highlight, where the detailed fact-finding should be directed, and to use in cross-checking the Government estimates that will be developed after fact-finding for each offeror.

B. SOLICITATION

The cost evaluation team needs to be sure that the solicitation clearly informs potential offerors of the cost evaluation criteria as well as the data needed to support the cost evalua-

tion. They can do this by including in the RFP or RFQ some or all of the clauses, modified appropriately, that were suggested in Section VI. Also, the cost evaluation team should specify in the RFP a WBS tailored to the particulars of the procurement and the types of data required. The WBS should introduce consistency among the offerors and highlight those areas where cost visibility is desired.

C. PROPOSAL EVALUATION/GOVERNMENT ESTIMATE

After receipt of the proposals, the cost evaluation team should review the cost proposals for completeness and consistency. Then they should conduct an extensive fact-finding at each of the offerors' plants which provides the opportunity to obtain clarifications, to examine additional backup data, and to request that the offerors justify their cost estimates based on their actual experience on previous programs.

After fact-finding and some further analysis and review, the cost evaluation team should develop a realistic Government estimate for each offeror. These Government estimates are based on the offeror's cost proposal, the data collected during fact-finding, and on data reviewed by DCAA (e.g., labor rates, overhead rates, G&A rates and vendor quotes). The Government estimates are prepared at the WBS item level--accepting the offeror's estimate as is for that line or adjusting the offeror's estimate based on an analysis of the offeror's history, on the correction of any errors found, and on the use of the Government's data base for other programs when the offeror's history is lacking or not relevant.

D. SCORING

With the scoring rules and weights established during the preparation of the source selection plan and the Government estimates for each offeror developed as part of the cost proposal evaluations, the cost evaluation team can then rate or score each of the proposals for Government estimated cost and cost realism. It is assumed that the cost evaluation team and SSA

decide to use numerical scoring because it provides the clearest understanding of the relative ranking of the various evaluation alternatives. It is also assumed that they prepare a cost evaluation summary that includes a narrative discussion and tabular and graphical displays of the scores and other cost information.

For this illustrative example, it is assumed that five offerors submit proposals with proposed costs as shown below. Government estimated costs which are assumed to have been developed by the cost evaluation team are also shown below.

<u>OFFEROR</u>	<u>PROPOSED COST (\$ Millions)</u>	<u>GOVERNMENT ESTIMATED COST (\$ Millions)</u>
A	\$47	\$48
B	47	54
C	53	50
D	60	65
E	89	70

It is convenient to calculate the Government estimated cost premiums compared to the lowest Government estimate ($(G-G^*)/G^* \% = D$) and the degree of realism of each offeror ($(C-G)/G \% = D'$). The cost evaluation team should make these calculations and prepare a tabular display as shown below:

ILLUSTRATIVE EXAMPLE FOR FSD PROGRAM
(Dollars in Millions)

<u>OFFEROR</u>	<u>OFFER (C)</u>	<u>GOV'T ESTIMATE (G)</u>	<u>GOV'T EST DELTA IN % (D)</u>	<u>REALISM DELTA IN % (D')</u>
A	\$47	48	--	-2.1
B	47	54	12.5	-13.0
C	53	50	4.2	+6.0
D	60	65	35.4	-7.7
E	89	70	45.8	+27.1

The cost evaluation team may also want to prepare two graphical presentations of their findings as shown in Figure 10.1. The tabular and graphical displays provide an excellent summary of the key cost evaluation data.

Next, the cost evaluation team should score each offer based on the scoring rules established earlier. The scoring rules are graphed in Figure 10.2. The scores for each offeror can either be read off the graph or computed using the computer model described in Appendix F. The scores, on a scale of zero to ten, are tabulated below.

SCORES (UNWEIGHTED)

<u>OFFEROR</u>	<u>GOVERNMENT ESTIMATED COST</u>	<u>COST REALISM</u>
A	10.0	10.0
B	7.2	4.5
C	9.1	8.0
D	2.0	7.2
E	1.0	1.0

These scores can then be weighted based on the Government estimated cost and cost realism weights of 20 percent and 10 percent, respectively, of the total evaluation score. This is shown below:

WEIGHTED SCORES				
<u>OFFEROR</u>	<u>GOV'T EST COST (20 MAX)</u>	<u>COST REALISM (10 MAX)</u>	<u>TOTAL COST EVAL (30 MAX)</u>	<u>TECH ADV TO EQUALIZE SCORE</u>
A	20.0	10.0	30.0	--
B	14.4	4.5	18.9	23 - 26%
C	18.1	8.0	26.1	7 - 9%
D	4.1	7.2	11.2	45%
E	2.0	1.0	3.0	82%

Offeror A has the highest cost evaluation score but offeror C's score is close. Also shown in this table is the degree of technical advantage that offeror B, C, D and E would have to have over offeror A in order to equalize their scores. The technical advantage is measured in terms of the percentage that B, C, D and E's technical score must exceed A's technical score

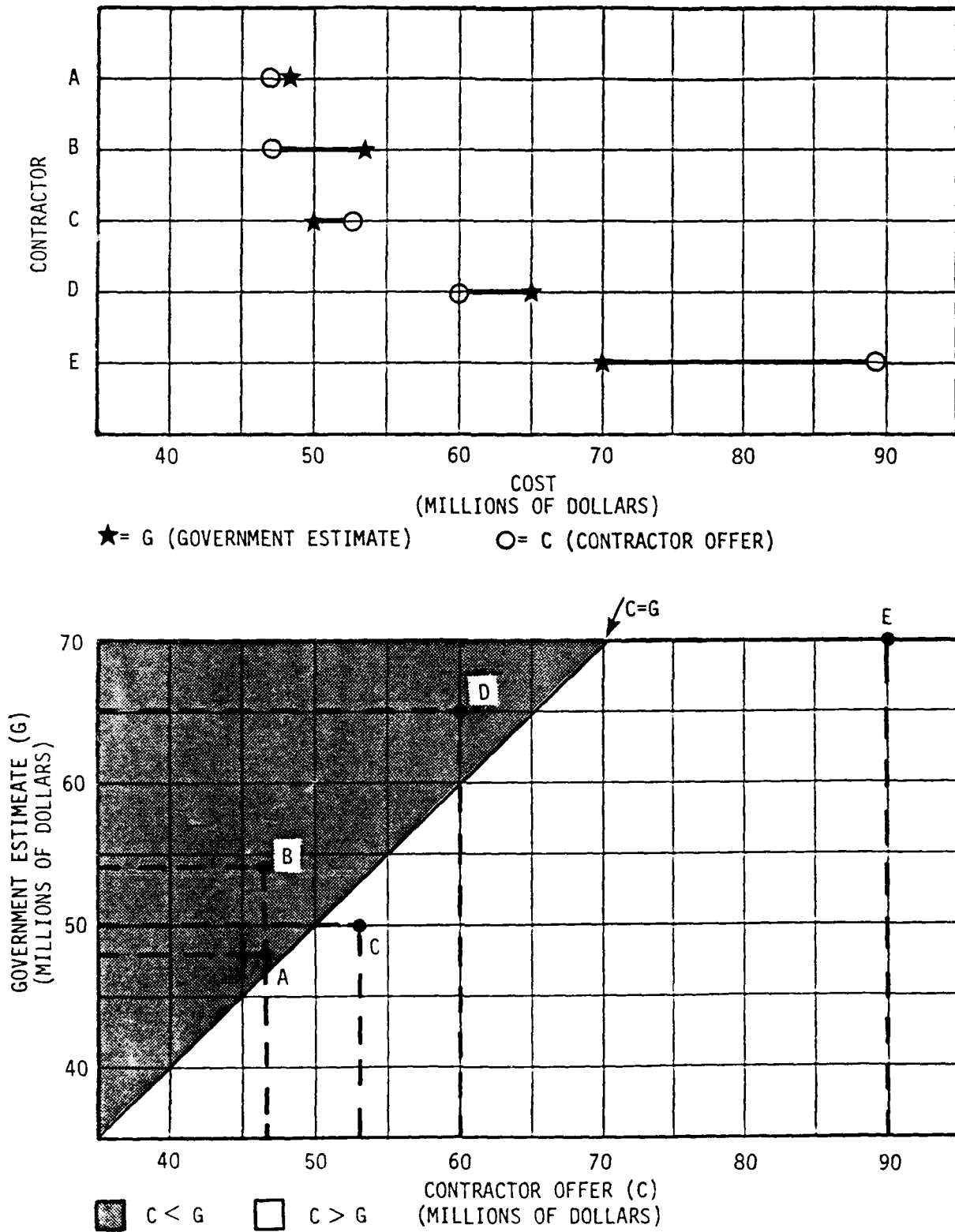


Figure 10.1. Graphical Presentation of Cost Evaluation Data

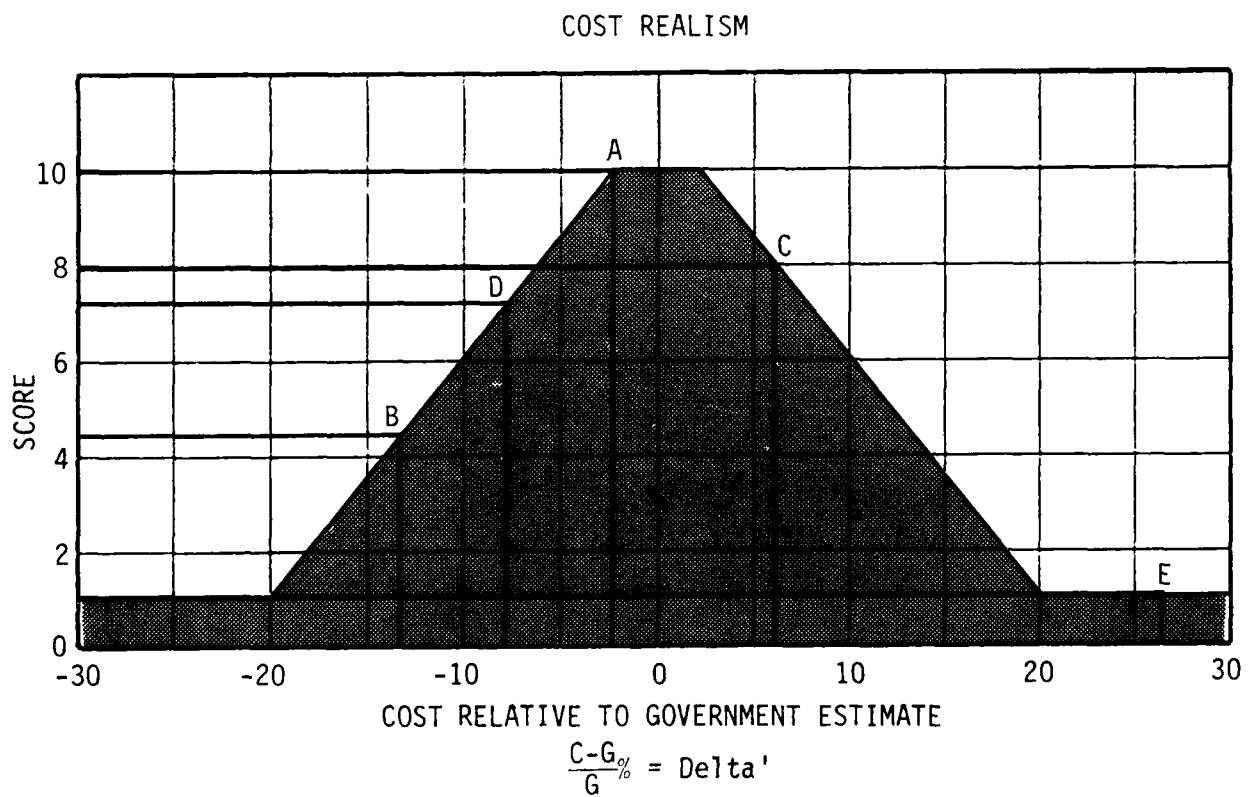
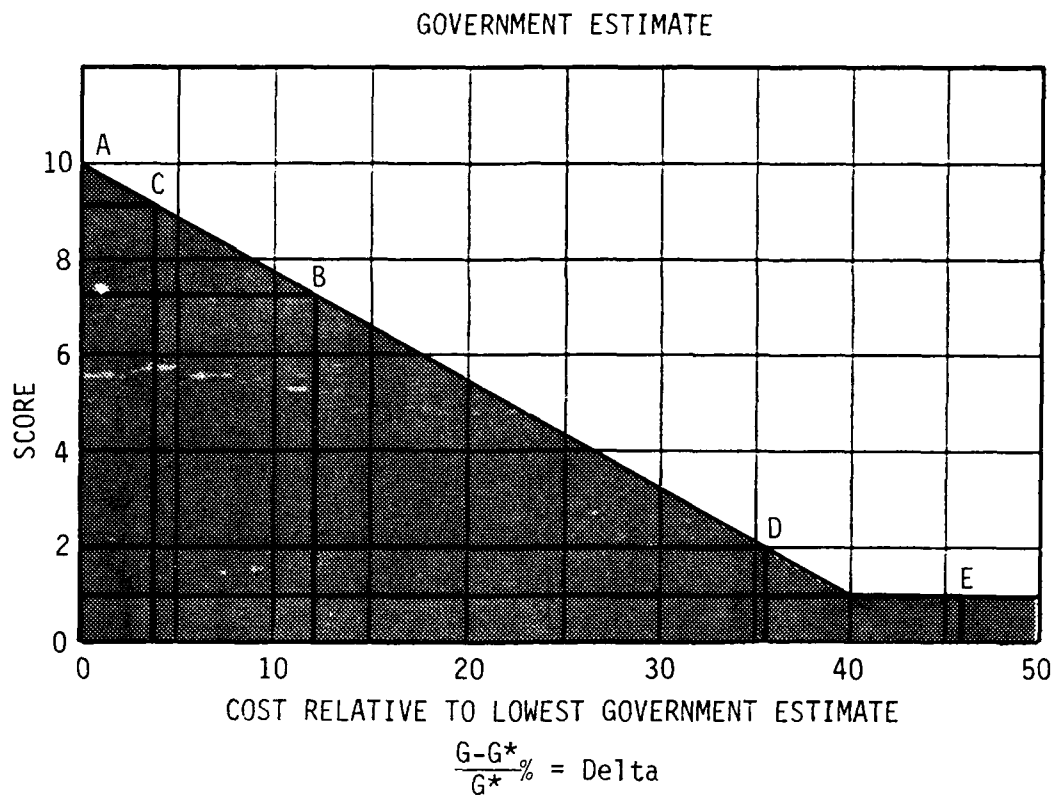


Figure 10.2. Government Estimated Cost and Cost Realism Scoring

to break-even (the range results from the assumption that the technical scores may be between 70 percent and 100 percent of the maximum technical score).

The above cost evaluation information together with a narrative summary of the cost evaluation team findings should be prepared and presented to the SSA and other appropriate source selection personnel.

Should the Government request best-and-final offers (BAFOs) from the offerors, then the cost evaluation and scoring must be revised based on the BAFO submittals.

SECTION XI

OTHER METHODS FOR ACHIEVING COST REALISM

The previous sections have discussed how the source selection cost evaluation process can encourage greater realism in contractor cost proposals. This section will briefly discuss additional methods for encouraging and achieving greater contractor cost realism. These methods include incentive type contracts, risk analysis by contractors in the preparation of proposals, past cost performance as a specific evaluation criterion, and development of realistic Government budgets. The extent to which one or more of these methods would encourage greater cost realism depends upon the particular procurement. Although other means for improving cost realism in contractor proposals may also exist, the following discussion will focus on those mentioned above.

A. CONTRACT TYPE

The Government uses different types of contracts in different procurement situations in an effort to control the costs, schedules and other aspects of a procurement. For the most part, the Government procures weapon systems through two basic contract types: cost reimbursement and fixed price.*

Cost Reimbursement Contracts

The Government normally awards cost reimbursement contracts during the RDT&E or the early production phases of a weapon system acquisition program when either the system or the manufacturing processes required to produce it (or both) involve major technological innovations. In such high risk situations, the Government may determine that other factors (such as pursuit of research with problematic results or the expansion of a system's performance parameters) have greater importance than

* In certain cases, four other contract types are used: letter, time and materials, labor, and indefinite delivery. The last three have little applicability to weapon systems acquisition programs.

cost alone and that it is willing to share the risk. Under these high risk conditions and in the absence of a cost reimbursable contract, potential contractors would probably include a significant cost reserve to cover their risk under a fixed price contract or decide not to bid the solicitation. Therefore, cost reimbursable contracts are an important, necessary part of the acquisition process.

Various versions of cost reimbursable contracts have been developed, differentiated primarily by the degree of risk the contractor assumes. The least risky version for the contractor is the cost-plus-fixed-fee (CPFF) contract, in which the Government pays all allowable costs as well as a fixed fee for performance of the contract. A CPFF contract provides no specific motivation to a contractor to prepare a realistic cost proposal. A contractor believing that the lowest bidder will generally be favored, all else being equal, may submit an unrealistically low offer knowing that, if he wins, the Government will pay all allowable costs. (Of course, there is the limitation that the Government program office may not be able to fund the overruns and, in the extreme case, the program might even be cancelled due to overruns).

In order to improve cost control and share some of the risk, the Government often uses incentive type cost-reimbursable contracts--cost-plus-incentive-fee (CPIF) and cost-plus-award-fee (CPAF). The CPIF contract encourages the contractor to control costs, since the Government and the contractor share allowable costs over a specific target cost; the contractor then maximizes his fee by performing below target cost. (However, the contractor may consider trading off fee for additional revenue above the target). Therefore, it is generally in the offeror's self-interest to propose realistic costs. An unrealistically low offer resulting in an unrealistically low (and probably unachievable) target cost would leave the contractor with little or no fee. Alternatively, an unrealistically high offer would place a contractor at a competitive disadvantage in the source selection.

The other cost reimbursable incentive arrangement is the CPAF contract, which includes both a negotiated fixed fee and an optional award amount for reaching specified management or system performance objectives. Like CPIF, CPAF contracts can be structured to provide offerors with an incentive to propose realistic costs.

Fixed Price Contracts

The Government prefers to use fixed price contracts after a contractor has established rate production of an item or when the item and its manufacture involve mature (and therefore predictable) technologies. In such situations, the Government encourages the contractor to reduce costs in order to maximize profits. The offeror will tend to propose realistic costs because failure to do so will affect his profits or the probability of award (too low, no profits or a loss; too high, no contract). Variations of the fixed-price contract are firm-fixed-price (FFP) and fixed-price-incentive (FPI). Fixed-price contracts encourage the contractor to propose realistic costs and to control costs during contract execution. An unrealistically low offer could mean not only little or no profit, but a loss; an unrealistically high offer would place a contractor at a competitive disadvantage in the source selection. However, fixed price contracts generally are not suitable for RDT&E programs.

In conclusion, incentive type cost-reimbursable contracts, as well as fixed price contracts, may encourage contractors to submit realistic cost proposals. However, unless the Government structures the incentives appropriately, they may not yield the desired results and the offerors may "game" them to the Government's disadvantage.

B. RISK ANALYSIS

A risk analysis is sometimes required by the Government as a part of a proposal. In particular, the Air Force requires risk analysis for major program source selections in AFR-70-15.

This document states that "offerors must be required to submit a risk analysis" and that they "will be required to identify the risk associated with their proposals in the areas of cost, schedule, or performance, together with realistic approaches for resolving or avoiding the identified risks (including backup development efforts)."

A risk analysis focuses attention on the risks and uncertainties of a particular procurement. It increases the probability that the contractor will account for risk during proposal preparation and therefore submit a more realistic cost proposal. Furthermore, the contractor's risk analysis should help the Government evaluate the cost proposal's realism.

Greater use of risk analysis may also encourage the Government to budget for risk through the use of appropriate management reserves (e.g., the Army's Total Risk Assessing Cost Estimate (TRACE) concept). While management reserves will not in themselves encourage greater contractor cost realism, they could help preserve a program's budget when a contract is awarded to an offeror whose cost proposal, and therefore the award, is unrealistically low. Thus, management reserves would reduce some of the undesirable consequences of unrealistically low cost proposals.

C. PAST COST PERFORMANCE

The Government generally includes past contractor performance in technical, management, cost, or other areas among the source selection evaluation criteria. For major programs, DOD Directive 4105.62 requires that past performance be a factor in the selection decision. Making offerors' recent, relevant cost experience (actual versus proposed) on cost reimbursable contracts an explicit evaluation criterion should encourage them to estimate their costs more realistically, since the degree of realism in their present offer may affect their ability to win future contracts.

D. REALISTIC BUDGET POLICY

Realistic budgeting not only by the Services and OSD but also by the Congress should have a positive, though indirect, effect on offerors' bids. Most offerors know either exactly or approximately the amount budgeted for a particular program and, independent of competitive pressures, may perceive (rightly or wrongly) that proposals over some amount will not sell. If an offeror's actual cost estimate exceeds this amount, he will be inclined to submit a proposal for less (i.e., an unrealistic cost proposal). Obviously, the Government can reduce or eliminate this problem by developing realistic budget estimates. This requires that the Government improve its ability to estimate budgets well in advance of solicitation release, based only on partially defined requirements.

APPENDIX A

DEFINITIONS

Definitions of some important terms used in this report are provided below.

Cost Analysis

The general sense of cost analysis as used in DOD is the development and application of concepts and techniques for assessing the costs of proposed military systems and capabilities. Cost analysis often involves the development and application of cost estimating relationships (CERs) based on the relationship between historical costs for systems or components of systems and various technical, performance and other characteristics. The FAR and ASPM No.1* define cost analysis in a somewhat different sense as follows:

The review and evaluation of a contractor's cost or pricing data and of the judgmental factors applied in projecting from the data to the estimated costs in order to form an opinion leading to a position on the degree to which the contractor's proposed costs represent what contract performance should cost, assuming reasonable economy and efficiency. It includes appropriate verification of cost data, evaluation of specific elements of costs and projection of these data to determine the effect on price factors like cost necessity, allowance for contingencies, and the basis used for allocation of overhead costs.

Cost/Price

In this report we use the terms cost and price interchangeably. The distinction that is often made between the terms is that price is cost plus a fee or profit. However, a contractor's "price" may be considered the Government's "cost."

The ASPM No. 1 defines price as "A monetary amount given, received or asked in exchange for property or services,

* Armed Services Procurement Regulations Manual for Contract Pricing (ASPM No. 1), Office of the Secretary of Defense, September 1975.

expressed in terms of a single item or unit of measure for such property or services."

Cost Realism

In this report we define cost realism as (1) in general, that part of the source selection process directed at assuring the reasonableness and defensibility of contractors' cost proposals and (2) more specifically, an evaluation criterion stated in the solicitation which compares the contractor's proposed cost with a detailed Government estimate for each contractor and then scores the degree of realism.

The terms cost reasonableness, defensibility, credibility and validity often have the same meaning as cost realism, depending on the context.

Government Estimated Cost

The "Government estimated cost" and "Government estimate" are terms used in this Handbook to refer to the likely cost that will be incurred as the result of awarding a particular contract. The likely cost is determined by a detailed Government estimate for each offeror (i.e., cost analysis in the sense of the FAR and ASPM No. 1). Parametric, analogy and other techniques of cost analysis which utilize cost data from a number of sources (e.g., actual costs for similar systems and industry wide factors) may be used to supplement the estimates based on specific contractor cost data.

Indifference Envelope

An indifference envelope is the combinations of technical capability and cost for which the cost evaluation team and the technical evaluation team would be indifferent or uncertain as to which contractor should receive the award.

Normal Curve

The normal curve is a symmetrical bell-shaped curve of a normal distribution whose "spread" is determined by the standard deviation.

Offerors/Contractors

These terms are often used interchangeably in this report. A private company awarded a contract by the Government is a "contractor." An offeror is a contractor (or a potential contractor) who submits a proposal or offer to the Government in response to a Government solicitation.

Price Analysis

The FAR and ASPM No. 1 make a distinction between price analysis and cost analysis. They define price analysis as follows:

The process of examining and evaluating a prospective price without evaluation of the separate cost elements and proposed profit of the individual offeror whose price is being evaluated. It may be accomplished by a comparison of submitted quotations, a comparison of price quotations and contract prices with current quotations for the same or similar items, the use of rough yardsticks (dollars per pound, for instance), or a comparison of proposed prices with independently developed Government estimates.

Scoring Rule

A scoring rule is a relationship which specifies the score associated with a particular evaluation criterion such as the Government estimated cost. The relationship may be expressed in equation or graphical form. Triangle, trapezoid and normal curve shaped scoring rules are recommended in this Handbook.

Spread

Scoring rules can be narrow or wide depending upon the degree of "spread". This Handbook characterizes spread in terms of S for triangle or trapezoid and twice the standard deviation (2σ) for a normal curve.

Technical Advantage

The technical advantage of one contractor relative to another is determined by the technical evaluation scores developed for each contractor.

APPENDIX B
ACRONYMS AND SYMBOLS

ASPM	Armed Services Procurement Regulation Manual for Contract Pricing
BAFO	Best-and-Final Offer
C	Contractor Offer
D	Percentage difference between G and G*
D'	Percentage difference between C and G
DAR	Defense Acquisition Regulations
DCAA	Defense Contract Audit Agency
DCAS	Defense Contract Administration Service
DOD	Department of Defense
DTUPC	Design-to-Unit Production Cost
FAR	Federal Acquisition Regulations
G	Government Estimated Cost
G*	Lowest Government Estimated Cost
IFB	Invitation for Bids
LCC	Life Cycle Cost
NAVAIR	Naval Air Systems Command
NAVELEX	Naval Electronic Systems Command
NAVSEA	Naval Sea Systems Command
PCO	Procurement Contracting Officer
PM	Project/Program Manager
R	Ratio of Government estimated cost weight to sum of Government estimated cost and cost realism weights
RDT&E	Research, Development, Test & Evaluation
RFP	Request for Proposals
RFQ	Request for Quotations
S	Spread or point at which the cost realism score reaches a minimum
SSA	Source Selection Authority
SSAC	Source Selection Advisory Council
SSEB	Source Selection Evaluation Board
SSP	Source Selection Plan
W	Ratio of Government estimated cost or cost realism weight to technical weight

WBS

Work Breakdown Structure

σ

Standard Deviation

APPENDIX C
POLICY DOCUMENT EXCERPTS

A number of policy documents were reviewed and excerpts related to source selection-cost evaluation are provided in this Appendix. The DAR has been superseded by the FAR; the wording in the FAR may not be exactly the same as the DAR excerpts in this Appendix.

Excerpts are provided in the following order:

	Page
Department of Defense	
DOD Directive 4105.62	C-2
Defense Acquisition Regulation (DAR)	C-5
Navy	
NAVMAT Instruction 4200.49	C-12
NAVELEX Instruction 4200.12C	C-14
NAVAIR Instruction 4200.24	C-17
NAVAIR Instruction 4200.27	C-19
Army	
AMC Regulation 715-1	C-21
Army Regulation 715-6	C-23
AMC Supplement 1 to AR 715-6	C-24
DARCOM Pamphlet 715-3	C-25
DARCOM Circular 715-8-80	C-33
Air Force	
Air Force Regulation 70-15	C-34
Air Force Regulation 80-15	C-43

6 January 1976

Excerpts related to cost evaluation:

- I. ...policy for the competitive solicitation, evaluation, and selection of contractual sources for the acquisition of major Defense systems in accordance with the basic philosophy outlined in reference (a)....
(reference (a) is DODD 5000.1)

- III. Policy. The following policy shall govern the solicitation, evaluation and source selection process as conducted by DOD Components.

- III.A. General

1. The prime objectives of the process are to (a) select the source whose proposal has the highest degree of realism and credibility and whose performance is expected to best meet Government objectives at an affordable cost....

2.b. In addition, the solicitation should be so structured so as to reflect the mission need, schedule, cost, capability objectives, and operating constraints but not technical approach or main design features.

3. Each DOD Component shall develop, and consistently apply, procedures which create the environment for an impartial, balanced and realistic appraisal of all proposals submitted.

- III.C. Solicitation

1. The Source Selection Plan. Prior to the issuance of the solicitation, a Source Selection Plan shall be approved by the Source Selection Authority. The plan will include the evaluation criteria in relative order of importance. In developing the criteria a proper balance shall be established among technical, cost, schedule, management and other factors.

2. Preparation of the Solicitation.

a. The solicitation should be designed so as to minimize competitor and Government expense incident to both preparation and response thereto....

c. It is essential that proposals (including revisions thereto) be submitted on a basis which permits verification of their cost credibility. To facilitate this objective and lay the groundwork for possible elimination of unrealistic cost proposals, as provided herein, every solicitation shall advise each competitor that his proposal is presumed to represent his best efforts to respond to the solicitation and any apparent inconsistency between promised performance and cost or price should be explained. Further, the solicitation should advise that any significant inconsistency, if unexplained, raises a fundamental issue of the competitor's understanding of the work required and/or of his ability to perform the contract, and may be grounds for rejection of the proposal, or a determination of nonresponsibility. The solicitation shall advise that the burden of proof of cost credibility rests with the offeror.

f. The solicitation shall identify the evaluation criteria against which all proposals will be evaluated. These criteria should be carefully

structured to assure emphasis on critical items or areas.

(1) Such criteria shall set forth the relative importance among technical, costs (development versus production versus operational and support costs), schedule, management and other factors as set forth in the Source Selection Plan.

- III.D. Evaluation

1. The evaluation shall assess both the proposal and the capability of each competitor to successfully accomplish the program under consideration. Past performance of each competitor, when it is relevant to the anticipated procurement, should be a factor in the selection decision to the extent indicated in the solicitation.

2. The primary goal of evaluation is to determine, for each competitor, the most likely outcome in terms of system characteristics, costs (development, production, and support), and schedules.

5. This paragraph and its subparagraphs establish a four step process....

5.b.(3)(a)

Prior to contractor selection, meaningful discussions will be conducted with all remaining offerors in connection with their respective cost/price proposals, either on an element-by-element basis or in their entirety.... The discussions of the cost/price proposals may include (a) cost realism of the offeror's proposal, (b) rectification and/or correction of inconsistencies or mathematical errors, (c) correlation of elements of cost with their respective technical efforts, and (d) discussion necessary to ensure a complete understanding of the Government's requirements and what is being offered, including delivery schedules, trade-offs among performance, design to cost, life cycle cost, and logistic support factors, and other contract terms.

5.b.(3)(d)

Any cost/price changes made during the discussion period including the finally revised proposal must be fully substantiated by the offeror. Supporting data must provide traceability to the causative technical, business, or financial conditions that brought about the change. In order to help identify "buy-ins", lump sum reductions in cost/price should not be accepted without supporting rationale.

5.b.(4)(b)

Proposals unrealistic in terms of technical or schedule commitments or unrealistically low in cost or price will be deemed reflective of an inherent lack of technical competence or indicative of failure to comprehend the complexity and risks of the contract requirements and may be grounds for rejection of the proposal.

5.b.(4)(c)(4)

Negotiations after selection shall not involve material changes in the Government's requirements or the contractor's proposal which affect the basis for source selection. In the event that such changes are desired by the Government, the competition will be reopened in accordance with existing ASPR requirements.

8. DOD Components shall develop an independent cost estimate to assist in determining the most probable costs (developmental, production, and support; especially the ability to meet the design to cost objectives) of each competitor's proposal. Parametric cost estimating techniques or

similar approaches should be used to the extent practical to determine the reasonableness of these costs. The Source Selection Authority shall base his selection on what, in his best judgment, is the most probable outcome (product performance, cost and schedule) for each proposal.

9. Unrealistically low cost estimates, initially or subsequently, may be grounds for eliminating a proposal from competition either on the grounds that the competitor does not understand the requirement or that he has made an improvident proposal. The burden of proof of cost credibility rests with the competitors. If the Source Selection Authority determines a competitor's estimates to be unexplainably low, that competitor may be eliminated from the competition.... Notice to this effect should be set forth in the solicitation.

Defense Acquisition Regulation (DAR)

Excerpts related to cost evaluation:

DAR Section III: Procurement by Negotiation

Part 8- Price Negotiation Policies and Techniques

- 3-801 Basic Policy

3-801.1 General. It is the policy of the Department of Defense to procure supplies and services from responsible sources at fair and reasonable prices calculated to result in the lowest ultimate overall cost to the Government. Good pricing depends primarily upon the exercise of sound judgment by all personnel concerned with the procurement.

3-801.2 Responsibility of Contracting Officers.

(a) ...The contracting officer shall avail himself of all appropriate organizational tools such as the advice of specialists in the fields of contracting, finance, law, contract audit, packaging, engineering, traffic management, and price analysis.

(b) ...Thus, determination of the suitability of the contract price to the Government always remains the responsibility of the contracting officer. For certain acquisitions, it may be necessary to convene a formal "Should Cost" (see 1-337) team of specialists to evaluate the contractor's cost projections, supporting standards, and other in-plant management, operational, and performance practices, on which cost projections are based.

(d) Pricing based on cost analysis involves, among other things, an appraisal of estimates of costs expected to be incurred in the future. The accounting projection of trends based on cost or pricing data, together with any known changes therein, is only one method of conducting this appraisal, others being:

(i) an engineering appraisal of the need for the estimated labor and material costs and of tooling and facilities, and the reasonableness of scrap and spoilage factors, and

(ii) the preparation of independent estimates by competent technical personnel.

Occasionally, differences of opinion will exist not only on the reasonableness of cost projections but also on the accounting techniques on which they are based.... The contracting officer is responsible for the exercise of the requisite judgments and is solely responsible for the final pricing decisions.

3-801.4 Responsibility of Pricing Personnel in Purchasing Office.

(a) The contract pricing team available to support the PCU in the review and analysis of pricing proposals includes the price analyst, negotiator, buyer, project engineer, and liaison auditor at the purchasing office.

(b) The price analyst or negotiator supporting the contracting officer may be designated to develop a Government pricing objective prior to the negotiation. This includes the responsibility for determining the extent

of advice required from other specialists, requesting, obtaining, and considering such advice, and for consolidating pricing data, including cost and price analyses, historical cost or pricing data, independent government cost estimates, economic analyses and the like. The advice and assistance of the price analyst/negotiator should always be obtained when complex pricing techniques are indicated, including the use of contract types involving skillfull balancing of price, cost and performance incentive arrangements. In many instances, he will be in the best position to conduct the price negotiation.

3-801.5 Responsibility of Field Pricing Support Personnel.

(a) Field Pricing Support. Field pricing support involves analysis of the contractor's pricing proposal by any or all of the field technical and professional specialists including, but not limited to, the Plant Rep/ACO; contract auditor; price analyst; quality assurance personnel, engineers; and legal and small business specialists. The Plant Rep/ACO is the team manager for all PCO requests for field pricing support. Therefore the PCO shall send all requests for field pricing support to the cognizant field contract administration activity; generally, the Plant Representative (Plant Rep) for the Services and the Administrative Contracting Officer (ACO) for DCAS(DSA). However, there shall be no constraints on the line of communication with the PCO/ACO and contract auditor interface.

- 3-806 Cost, Profit, and Price Relationships.

(a) When the products are sold in the open market, costs are not necessarily the controlling factor in establishing a particular seller's price. Similarly where competition may be ineffective and lacking, estimated costs plus estimated profit are not the only pricing criteria. In some cases, the price appropriately may represent only a part of the seller's cost and include no estimate for profit or fee, as in research projects where the contractor is willing to share part of the costs. In other cases, price may be controlled by competition as set forth in 3-805.1. The objective of the contracting officer shall be to negotiate fair and reasonable prices in which due weight is given to all relevant factors.

(b) ...While the public interest requires that excessive profits be avoided, the contracting officer should not become so preoccupied with particular elements of a contractor's estimate of cost and profit that the most important consideration, the total price itself, is distorted or diminished in its significance. Government procurement is concerned primarily with the reasonableness of the price which the Government ultimately pays, and only secondarily with the eventual cost and profit of the contractor.

- 3-807 Pricing of Negotiated Contracts.

3-807.1 General. Policies set forth in this part may be applied in a variety of ways in evaluating proposals and negotiating contract prices. These provisions apply equally to initial and subsequent price negotiations.

(a) Definitions.

(1) Cost or pricing data consists of all facts existing up to the time of agreement on price which prudent buyers and sellers would reasonably expect to have a significant effect on price negotiations. Cost

or pricing data embraces more than historical accounting data. It also includes such factors as all vendor quotations, nonrecurring costs, changes in production methods and production or procurement volume, data in support of contractor projections of business prospects and objectives, together with related costs of operations, unit cost trends such as those associated with labor efficiency, make or buy decisions and estimated resources to attain business goals and any other management decisions which reasonably could be expected to have a significant bearing on costs under a proposed contract, e.g., the comparative analysis by which a particular vendor was selected. In short, cost or pricing data consist of all facts which reasonably can be expected to contribute to sound estimates of future costs as well as to the validity of costs already incurred. Cost or pricing data, being factual, are that type of information which can be verified.

(2) Price analysis is the process of examining and evaluating a prospective price without evaluation of the separate cost elements and profit proposed by the individual prospective supplier whose price is being evaluated.

(3) Cost analysis is the review and evaluation of a contractor's cost or pricing data and of the judgmental factors applied in projecting from the data to the estimated costs, in order to form an opinion on the degree to which the contractor's proposed costs represent what performance of the contract should cost, assuming reasonable economy and efficiency.

(d) Requirements for Price or Cost Analysis. Some form of price or cost analysis is required in connection with every negotiated procurement action. The method and degree of analysis, however, is dependent on the facts surrounding the particular procurement and pricing situation. Cost analysis shall be performed when cost or pricing data are required to be submitted. The extent of cost analysis should be that necessary to assure reasonableness of the pricing result, taking into consideration the amount and complexity of the proposed contract. Price analysis should be used in all other instances to determine the reasonableness of the proposed contract price. Normally, a sound conclusion as to value cannot be made on cost analysis alone. Depending on the information available, a price arrived at by cost analysis should be corroborated through price analysis techniques.

3-807.2 Price Analysis and Cost Analysis Techniques.

(a) Price analysis may be accomplished in various ways including:

- (1) the comparison of the price quotations submitted;
- (2) the comparison of prior quotations and contract prices with current quotations for the same or similar end-items (to provide a suitable basis for comparison, appropriate allowances must be made for differences in such factors as time of prior purchases, specifications, quantities ordered, time for delivery, Government-furnished materials, and experienced trends of improvement in production efficiency; it must also be recognized that such comparison may not detect an unreasonable current quotation unless the reasonableness of the prior prices was established and unless changes in the general level of business and have been considered);
- (3) the use of parametric relationship measurements or rough yardsticks (such as dollars per pound, per horsepower, or other units), to point up apparent gross inconsistencies which should be subjected to greater pricing inquiry;

(4) the comparison of prices set forth in published price lists issued on a competitive basis, published market prices of commodities and similar indicia, together with discount or rebate arrangements; and

(5) the comparison of proposed prices with estimates of cost independently developed by the Government.

(b) (1) Cost Analysis includes the appropriate verification of cost or pricing data, the evaluation of specific elements of costs and the projection of these data to determine the effect on prices of such factors as:

- (i) the necessity for certain costs;
- (ii) the reasonableness of amounts estimated for the necessary costs;
- (iii) allowances for contingencies;
- (iv) the basis used for allocation of indirect costs; and
- (v) the appropriateness of allocations of particular indirect costs to the proposed contract.

(2) Cost analysis shall include appropriate verification that the contractor's cost submissions are in accordance with Section XV, Contract Cost Principles and Procedures, and when applicable Appendix U, Rules, Regulations and Standards of the Cost Accounting Standards Board.

(3) Among the evaluations that should be made, where the necessary data are available, are comparisons of a contractor's or offeror's current estimated costs with:

- (i) actual costs previously incurred by the contractor or offeror;
- (ii) either his last prior cost estimate or a series of prior estimates for the same or similar items;
- (iii) current cost estimates from other possible sources;
- (iv) prior estimates or historical costs of other contractors manufacturing the same or similar items; and
- (v) forecasts or planned expenditures.

(4) Forecasting future trends from historical cost experience is of importance, but care must be taken to assure that the effect of past inefficient or uneconomical practices are not projected into the future. An adequate cost analysis must include an evaluation of trends and changes in circumstances, if any, and their effect on future costs.

3-807.3 Requirements for Cost or Pricing Data

(a) When appropriate, the contracting officer shall require the contractor to submit, either actually or by specific identification in writing, cost or pricing data in support of his proposal. The contracting officer also shall require the contractor, in circumstances specified in (b) below, to certify, using the certificate set forth in 3-807.6, that the cost or pricing data are accurate, complete, and current....

(b) Cost or pricing data are required as part of a proposal leading to, and certification is required prior to:

(i) the award of any negotiated contract (except for unpriced actions such as letter contracts) expected to exceed \$100,000 in amount....

(iii) ...unless the price negotiated is based on adequate price competition, established catalog or market prices of commercial items sold

in substantial quantities to the general public, or prices set by law or regulation....

(c) Unless required to be submitted on one of the termination forms set forth in 16-700, data will be submitted on the DD Form 633. The requirement for submission of cost or pricing data is met when all cost or pricing data reasonably available to the contractor have been submitted or identified in writing at the time of agreement on price. The data shall be submitted to the contracting officer or his representative. There is a clear distinction to be made between "submitting" cost or pricing data and merely "making available" books, records and other documents without identification. The latter does not constitute submission of cost or pricing data.

3-807.4 Subcontractor Cost or Pricing Data.

(a) Any contractor who is required to submit and certify cost or pricing data shall be required to submit accurate, complete and current cost or pricing data from prospective subcontractors in support of each subcontract cost estimate included in the contractor's submission. This submission shall be required whenever the contracting officer considers such data necessary for pricing the prime contract, or, in any event, whenever such subcontractor cost estimate is either (i) \$1,000,000 or more, or (ii) both more than \$100,000 and more than 10 percent of the prime contractor's proposed contract price....

(b) ...Failure by the contractor to submit subcontract cost or pricing data may be the cause for disqualification of the contractor from further consideration for award of the proposed contract....

- 3-809 Contract Audit as a Pricing Aid.

(a) General. Contract audit services are available in two forms:

(i) Audit reports setting forth the results of auditor's reviews and analyses of cost data submitted by contractors as part of pricing proposals, reviews of contractor's accounting systems, estimating methods, and other related matters; and

(ii) "On the spot" personal consultation and advice to contracting and contract administration personnel in connection with analyses of contractors' cost representations and related matters by liaison auditors stationed at contracting and contract administration offices....

(b) Audit Reports on Contractor Price Proposals....

(c) Additional Functions of the Contractor Auditor....

DAR Section IV: Special Types and Methods of Procurement

- 4-106.2 Solicitation.

(f) Solicitations shall require offerors to identify technical uncertainties and to make specific proposals for their resolution.

(g) Solicitation and evaluation of proposals should be planned to minimize offerors' and Government expense.

- 4-106.4 Evaluation for Award.

(a) Generally, research and development contracts should be awarded to

those organizations, including educational organizations, which have the highest competence in the specific field of science or technology involved.

(c) In determining to whom the contract shall be awarded, the Contracting Officer shall consider not only technical competence, but also all other pertinent factors including management capabilities, cost controls, and past performance in adhering to contract requirements, weighing each factor in accordance with the requirements of the particular procurement.... Proposals for cost reimbursement type or fixed price incentive contracts may be penalized during evaluation to the degree that the estimated cost is unrealistically low.

- 4-106.5 Evaluation of Price and Costs.

(a) While cost or price should not be the controlling factor in selecting a contractor for a research or development contract, cost or price should not be disregarded in the choice of the contractor. It is important to evaluate a proposed contractor's cost or price estimate, not only to determine whether the estimate is reasonable but also to determine his understanding of the project and ability to organize and perform the contract. The most useful tools for this purpose are price analysis and cost analysis (see 3-807.2).

(b) Price analysis generally considers the overall reasonableness of the proposals in relation to the total contemplated expenditures and the extent and nature of the task scheduled to be accomplished. In most research and development contracts, the inability to define specifications and the nature of the end items prevent the effective use of certain techniques of price analysis, such as comparisons with prior quotations and current prices and evaluations in terms of quantitative yardsticks. The conclusions reached by price analysis techniques must be supported by cost analysis procedures, used to examine the details of the offerors' proposals.

(c) The analysis of cost factors begins with an evaluation of the reliability of the offeror's cost estimating procedures and the dependability of his cost controls, as demonstrated by his history of cost management in the performance of other contracts or by his establishment of sound practices for this purpose. The cost analysis proceeds with a critical examination of the composition of each cost element in terms of its expected application to the objectives of the contract, and its conformance to the accepted principles of allocability and reasonableness. (See Section XV, Part 3, and 15-201.) A Government cost estimate may help in projecting tools for these purposes and may develop the expected incidence of various cost factors in relation to performance phases, planned segments, or identifiable "milestones." This estimate should provide a summary forecast of the time, effort, materials, equipment, and services necessary to accomplish the research or development objective. The comparison and reconciliation of the Government cost estimate with the offeror's cost estimate for the same phases, segments, or events should provide a foundation for meaningful discussions with the offeror.

(d) Special care should be exercised to comply with 15-205.1 and 15-205.33 in the allowance of advertising costs under 15-309.1.

DAR Section XV: Contract Cost Principles and Procedures

- 15-000 Scope of Section. ...contains general cost principles and procedures for the pricing of contracts and contract modifications whenever cost analysis is performed (see 3-807.2), and for the determination, negotiation, or allowance of costs when such action is required by a contract clause.

- 15-109 Definitions....

(a) Profit Center....

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(m) Reporting Costs

- Part 2- Contracts with Commercial Organizations

- 15-201.1 Composition of Total Cost. The total cost of a contract is the sum of the allowable direct and indirect costs allocable to the contract, incurred or to be incurred, less any allocable credits. In ascertaining what constitutes costs, any generally accepted method of determining or estimating costs that is equitable under the circumstances may be used, including standard costs properly adjusted for applicable variances.

- 15-201.2 Factors Affecting Allowability of Costs. Factors to be considered in determining the allowability of individual items of cost include (i) reasonableness, (ii) allocability....

- 15-201.3 Definition of Reasonableness.

(a) General. A cost is reasonable if, in its nature or amount, it does not exceed that which would be incurred by an ordinarily prudent person in the conduct of competitive business. The question of the reasonableness of specific costs must be scrutinized with particular care in connection with firms or separate divisions thereof which may not be subject to effective competitive restraints. What is reasonable depends on a variety of considerations and circumstances involving both the nature and the amount of the cost in question. In determining the reasonableness of a given cost, consideration shall be given to-

(i) whether the cost is of a type generally recognized as ordinary and necessary for the conduct of the contractor's business or the performance of the contract;

(ii) the restraints or requirements imposed by such factors as generally accepted sound business practices, arms length bargaining, Federal and State laws and regulations, and contract terms and specifications;

(iii) the action that a prudent businessman would take in the circumstances, considering his responsibilities to the owners of the business, his employees, his customers, the Government and the public at large; and

(iv) significant deviations from the established practices of the contractor which may unjustifiably increase the contract costs.

NAVMAT Instruction 4200.49
Selection of Contractual Sources for Major Defense Systems
28 February 1977

Excerpts related to cost evaluation:

- Instruction amplifies DOD Directive 4105.62, same title, where appropriate.
- 3. The provisions apply to (i) competitive procurements covering one or more contractors as a prime development and/or production contractor(s) for programs which have an estimated RDT&E cost in excess of \$75 million...and (ii) such other competitive procurement as may be so directed by the Chief of Naval Material.
- 4.b. Unless otherwise specified by the Secretary of Defense for a specific program, the Secretary of the Navy (SECNAV) is the Source Selection Authority (SSA) for all Navy defense systems designated major pursuant to reference (a), with power of delegation at his discretion. (reference (a) is DOD Directive 5000.1).
- 5.a. Unless otherwise approved by the Source Selection Authority, each program subject to the provisions of this instruction shall establish and effectively employ an evaluation group structure consisting of a Source Selection Advisory Council (SSAC) and Source Selection Evaluation Board (SSEB) except that such a structure is not mandatory where the source selection decision is to be based solely on price.
- 6. The Source Selection Plan. The Source Selection Plan (SSP) shall describe in detail the plan for the conduct of the entire source selection process including solicitation preparation and review, proposal evaluation, source selection and contract award. As a minimum, the SSP shall contain...(iv) the evaluation criteria listed in the relative order of importance; (v) the evaluation procedures to be employed by the evaluators including the methods for scoring/grading the proposals; but excluding any numerical weights which may be employed....
- 7. Preparation of the Solicitation.
 - a. The mere listing of the evaluation criteria in relative order of importance may not suffice to even inform prospective offerors of the broad basis on which their proposals will be evaluated. For example, there may be a situation where the importance of a single evaluation factor far outweighs all other evaluation factors. When such a situation exists, the predominant value accorded this factor should be disclosed along with the relative order of importance of the remaining factors provided, however, that the ASPR 3-501 Section d(i) prohibition against the disclosure of any numerical weights which may be employed in the evaluation process is not violated.
- Enclosure (2) Duties and Responsibilities of the Source Selection Authority (SSA).

5. Ensure that cost (development, production, and support) is appropriately considered as an integral element of proposal evaluation, together with technical, performance, schedule and logistic support objectives, in accordance with the relative order of importance of the evaluation and selection criteria.

- Enclosure (4) Duties and Responsibilities of the Procuring Contracting Officer.

5. Assure that proposals are requested on a basis which permits verification of their cost credibility.

- Enclosure (5) Duties and Responsibilities of the Source Selection Advisory Council.

2. Develop the criteria for evaluation and selection in a relative order of importance and establish any numerical weights which may be employed.

- Enclosure (7) is a source selection schematic.

NAVELEX Instruction 4200.12C
Proposal Evaluation and Source Selection
31 August 1978 with Change 1 of 5 February 1979

Excerpts related to cost evaluation:

- 3. Applicability. The provisions of this instruction are applicable to all competitive negotiated procurements....
- 5. Policy. It is the policy of the Naval Electronics Systems Command to assure impartial equitable and comprehensive evaluation of offers and selection of the source or sources whose offer provides the greatest advantage to the Government after consideration of performance, schedule and cost.
- 6. Thresholds.
 - a. Major Defense System. Program procurements exceeding...RDT&E cost in excess of 75 million dollars or production costs in excess of 300 million dollars will in all cases employ the formal source selection method prescribed in Enclosure (1).
 - b. Other Procurements.... Generally, the formal selection procedures shall not be considered for procurements under 10 million dollars, except under the most exceptional circumstances....
- 7. Solicitation Provisions.
 - a. General.... Evaluation factors will be limited to those which are essential to the selection of the offeror most likely to satisfy the Government's requirements in terms of cost, schedule and performance. Generally, offerors shall be required to submit cost/price information separately from technical portions of proposals....
- 10. Timeliness of the Source Selection Process. Source selection must be completed expeditiously.... Under normal circumstances, the evaluation period should not exceed thirty days....
- 13. Basis for Proposal Evaluation.
 - a. Evaluation. Contracts will be awarded on the basis of maximum advantage to the Government, cost or price and other factors considered.... A numerical scoring system will be employed which will translate the word descriptions into quantitative terms....(see Enclosure (3)).
 - b. Weighting. All evaluation factors listed in the RFP will be assigned weights, except that weighting cost is not mandatory for proposed cost type contracts for early conceptual effort involving high technical risk. Cost may be excluded from weighting in such cases with the concurrence of the PCO; however the evaluation of costs will precede and be a factor in the establishment of competitive range and the relationship of cost factors to other evaluation criteria will be adjudicated to the satisfaction of the PCO in recommendation and selection for award. The summation of weighted scores will not be the sole basis for the selection of a source. Such scores, however, may provide compelling support for determinations of competitive range or source selection. For that reason, it is imperative that weighted scores reflect as accurately as possible the

substantive aspects of the proposals and their differences, and that such scores positively discriminate between proposals of significantly varying merit, where such is the case.... Every effort should be made to insure that the evaluation process is not reduced to a mere statistical computation. These evaluation weights will be kept by the Chairman of the CARP and will normally be available only to the SSA and the PCO.

c. Evaluation Results. Generally, evaluation results should categorize proposals as (1) acceptable (i.e., acceptable for discussion/negotiation purposes), (2) susceptible of being made acceptable (i.e., where deficiencies are such that a reasonable amount of discussion may make the proposal acceptable) and (3) unacceptable (i.e., where such deficiencies exist as to preclude possibility of meaningful discussions and opportunity for award). In the event that a proposal contains a major deficiency in a critical area, the proposal may be determined to be unacceptable despite an overall numerical score supporting an acceptable rating, provided, however, that such criteria are identified in the solicitation and are incorporated in the evaluation plan.

- 15. Competitive Range.

a. Basis for Determination.... A proposal is within the competitive range unless so technically inferior or out of line in price that meaningful negotiations are precluded. Cost or price as well as technical factors must be considered in determination of the competitive range....

- Enclosure (1): Formal Source Selection Procedures.

3. Source Selection Plan.

a. Preparation and Approval.... The plan shall include as a minimum....

b. Evaluation of Costs. To assist the SSAC in evaluating the cost or price proposals, the Source Selection Plan may provide for a special panel similar to the SSEB to evaluate the proposals and rank them according to their overall costs or prices as well as cost credibility, if appropriate. This special panel's report shall be used in conjunction with the SSEB report to form the basis for the SSAC's recommendations. The PCO/negotiator will normally be a member of the cost evaluation panel.

- Enclosure (2): Standard Procedures for Proposal Evaluation and Source Selection

1. General.... The documentation developed during the evaluation process will be adequate to both support the action taken and to debrief unsuccessful offerors.

- Enclosure (3): Scoring Techniques and Standards

1.0 Detailed evaluation of proposals will be made by individual evaluators who will consider the merits of specific portions of each proposal against the established criteria. Primary emphasis in evaluating proposals will be placed on the analysis of the way each offeror proposes to satisfy the RFP requirements, the risks and costs associated with the proposed effort, and the reduction of such analysis to descriptive words

and phrases. The numerical scoring system detailed herewith will be used to translate the word descriptions into quantitative terms.... The objectives of using these standards are to promote uniformity in evaluation and to aid in comparison and understanding of evaluation results.

The following standards are established for this evaluation:
Excellent, good, fair, poor, and unacceptable.

NAVAIR Instruction 4200.24
Selection of Contractual Sources for Major Aircraft and Missile System
Acquisitions
1 July 1977.

Excerpts related to cost evaluation:

- Implements NAVMATINST 4200.49 of 28 Feb 1977

- 3. Background. ...It is the objective of the proposal evaluation and source selection process to select the source/design which best satisfies the requirements of the Government at an affordable cost.

- 4. Policy and General Procedures. It is the policy of NAVAIR HQ to utilize design competitions for selecting contractors for the development, design and manufacture of major weapon systems. In carrying out this policy, the following will be accomplished:

a. Effect source selection procedures which will choose the best weapon system design from those potentially available, and which result in the greatest gain in military effectiveness (as generally established by the applicable operational requirement) within the expected available resources (time, funds, and facilities) and other known constraints.

b. Effect all source selections with rigorous impartiality.

c. Utilize procedures which, in themselves, make effective and efficient use of time, money and manpower by both the Government and the offerors.

d. Establish as explicitly as practical all known constraints which must be satisfied by the weapon system to be selected. These constraints shall include (1) time..., (2) total and incremental cost constraints, (3) operational constraints...and (4) policy and other constraints.

- 5. Organization.

a. Source Selection Authority(SSA). The duties and responsibilities of the SSA are contained in NAVMATINST 4200.49.

b. Source Selection Advisory Council (SSAC).... In addition to the responsibilities set forth in reference (a), the SSAC shall also perform the following:

(1)....

(5) Assure that the source selection procedures promote consistency in an integrated evaluation of:

(a) estimated military effectiveness of the weapon system;

(b) estimated life cycle cost of the weapon system; and

(c) risk associated with each of the above two estimates.

c. Source Selection Evaluation Board (SSEB).... The SSEB shall also perform the following:...(2) Evaluate the proposals against the technical requirements and military effectiveness models and estimate:...(c) the life cycle cost of the weapon system.

d. Source Selection Plan (SSP). A plan for conducting the solicitation, proposal evaluation, negotiation, and source selection. Matters to be described in, and connected with, the SSP are covered in reference (a). (Reference (a) is NAVMATINST 4200.49.)

- 6. General Source Selection Process
 - a. Announcement of Solicitation....
 - b. Solicitation (RFP/RFQ)....
 - c. Bidder's Conference....
 - d. Evaluation Procedure. The evaluation of proposals and quotations shall be carried out against standards established in the SSP and the RFP/RFQ. Ad hoc groups may be established within the various disciplines (such as technical, logistic, cost, management) to support the SSEB, if desired.... It is essential that each evaluator have the necessary expertise to perform a valid analysis by independent and realistic appraisal. These skills must be built up in a core of knowledgeable and professionally competent personnel in specialty areas from past experience in source selection and in similar or related programs to provide essential mature judgment and expertise in the evaluation....
 - e. Inquiries to Offerors. During the evaluation, it may be desirable to make inquiries to the offerors to eliminate uncertainties or irregularities and/or provide the offeror an opportunity to better substantiate a proposed technical approach or solution. This would normally occur when such inquiries would provide for more effective competition. All inquiries will be made through, or in the presence of, the Contracting Officer or his designated representative. Deficiencies clearly related to an offeror's judgment, or his lack of competence or inventiveness in preparing his proposal, shall not be disclosed.
 - f. Competitive Range and Discussions with Offerors (ASPR 3-805.2 and 3-805.3)....
 - g. Final Negotiations. Negotiations with offeror(s) will be conducted by the Contracting Officer to:
 - (3) assure the reasonableness of the proposed costs/prices.
 - h. Evaluation Report....
 - i. Award. Based on facts and findings of the SSEB and the recommendations of the SSAC, the SSA will make the decision as to source selection(s). Award will be on the basis of the overall best proposal to the Navy, technical, cost, and management factors considered....

7 November 1980

Excerpts related to cost evaluation:

- 5. Definitions....

b. Less-Than-Major Acquisition. Those competitive procurements that do not meet the cost criteria established for major acquisitions or are not designated as major acquisitions by higher authority.

- 6. Policy.

a. ...Formal source selections shall follow the procedures defined in enclosure (1).... Formal source selection procedures shall be used for those procurements which involve technical competition if the acquisition cost is greater than \$5.0M RDT&E or \$25.0M production.... Technical competition exists when at least 50 percent of the evaluation criteria for award is based on technical or other factors in addition to price or cost....

- Enclosure (1): Formal Source Selection Procedures and Requirements

3c. ...the SSEB shall also...evaluate the proposals against the solicitation requirements and estimate...(c) the life cycle cost associated with the proposed item or concept design....

5. Source Selection Criteria.... The criteria must include all relevant areas (for example, technical, cost, supportability, schedule, risk and management) in the relative order of importance. They must be stated with sufficient generality to encompass all evaluation issues, including ones which may not be foreseen at the time of SSP preparation. Lengthy, detailed criteria which attempt individually to address all evaluation elements shall be avoided.

9b. It is often argued that rating of proposals by the SSEB should be accomplished via detailed, pre-established numerical scoring systems. However, experience has shown that use of such systems is contrary to the goal of an efficient source selection and, moreover, that such systems often lead to a selection which is other than the one most advantageous to the Government. Therefore, the use of numerical scoring ("point") systems by the SSEB for the rating of proposals is strongly discouraged. The use of pre-established point systems is prohibited. A pre-established point system is one that is formulated and defined prior to receipt of the proposals. It represents an attempt by members of the SSEB to prejudge the relative absolute importance of the many unidentified subelements of the selection criteria prior to knowing what all of those subelements are or exactly how they relate. Instead, quantitative factors (for example, speed, range, cost) shall be measured in their normal units of measure (that is, knots, nautical miles, dollars) and compared against the RFQ/P requirements, if established, and qualitative factors shall be treated using descriptive terms such as those shown in Table IV. Such ratings always must be supported by specific rationale developed by the evaluation process.

13. ...Discussions/negotiations will be held with the offerors who are within the competitive range. Contracting Officer negotiations with such offerors shall:

(1) resolve all exceptions made by NAVAIR HQ and the offerors to the terms and conditions of proposed contracts;

(2) incorporate technical and specification changes determined by the SSEB to be necessary;

(3) advise the offerors in those areas where their proposal does not meet solicitation requirements; and

(4) ensure the reasonableness of the proposed costs/prices.

15. Award.... Award will be on the basis of the overall best proposal to the Navy, technical, cost, schedule, supportability, risk and management factors considered.... Unsuccessful offerors shall be given the opportunity, if they so request, for an informal de-briefing on the results of the evaluation of their particular proposals. It is of benefit to the Government and to such offerors to identify deficiencies which will provide an understanding for their non-selection.... The debriefings shall be limited to the evaluation of important aspects of the proposal against the requirements of the RFP/RFQ....

Sample qualitative proposal ratings:
Exceptional, acceptable, marginal, and unacceptable

AMC Regulation 715-1
Cost Realism in Proposal Evaluations
1 October 1970

Excerpts related to cost evaluation:

- 1. Purpose. This regulation prescribes the objectives, policy, responsibilities, procedures, and guidance in the preparation and use of cost realism in proposal evaluation procurements.
- 3. Definitions.
 - a. Cost realism is defined as the employment of preplanned methods to determine the probable total cost for a procurement at completion; cost realism involves a comprehensive analysis to develop and establish the probable overall cost of performance when related to the required technical scope of the work.
- 4. General. Cost realism will be used in all procurements in which multiple evaluation factors are set forth in the solicitation document.
- 5. Objectives.
 - a. This regulation is issued to stress cost realism procedures as a method used to reduce cost growth and inaccurate cost estimating on the part of both the Government and the potential contractors.
 - b. Cost realism procedures will be used during the presolicitation, solicitation, cost evaluation and negotiation processes.
- 6. Policy.
 - a. It is the policy of Headquarters, AMC, that Defense contractors will be advised of the need for cost realism in their proposals and that it will become a major factor in the selection process for the award of contracts.
 - b. Cost realism procedures will be used in consonance with sound cost estimating and pricing practices to determine the reasonableness of prospective contractors' proposals.
- 7. Responsibilities....
 - b. The Commander...will assure that qualified pricing, contracting, legal, and technical personnel are available to assist the procuring contracting officer (PCO) in applying cost realism procedures as prescribed by paragraph 8.
 - c. Each PCO will assure that cost realism procedures are used during proposal analysis and subsequent negotiations when the procurement falls within the purview of this regulation.
- 8. Procedures.
 - a. The cost realism evaluation plan will be tailored expressly for each procurement and the method outlined in the solicitation document. Examples of standards which may be used for evaluation purposes are:
 - (1) Are the proposed elements of cost (labor, material, and other costs) realistic, reasonable, and consistent with the work to be performed, as outlined in the offeror's technical proposal?

- (2) Are the costs so excessively high or excessively low as to indicate the offeror's lack of understanding or capability to perform?
- (3) Does the cost data indicate any areas of inadequacy or areas of nonessential effort?
- (4) How does the contractor's record of previous cost performances compare with the initial negotiated amounts on past contract awards?
- (5) How well has the contractor associated his costs to the technical scope of work which he has proposed?
- (6) If an Independent Government Cost Estimate was prepared, how well does the contractor's proposal compare with it?
- (7) How complete is the cost data as submitted by the contractor?
- (8) What is the responsiveness of the contractor during negotiations? Is the contractor willing to accept ceilings on particular elements of costs such as overheads?

b. The weight assigned to cost on production type procurements will not be less than 30 percent of the total weight to be used for evaluation purposes. On research and development type contracts, an appropriate weight will be used to assure that cost as a separate element will be considered.

Army Regulation No. 715-6
Procurement Proposal Evaluation and Source Selection
21 September 1970

Excerpts related to cost evaluation:

- 3. Objectives.

a. The prime objectives of proposal evaluation and source selection are to--

(1) Insure impartial, equitable, and comprehensive evaluation of proposals.

(2) Insure selection of that source whose proposal, as submitted, offers optimum satisfaction of the Government's objectives, including cost, schedule, and performance.

- 5. Principles and techniques.

a. Decision latitude. It is intended that the source selection authority have a maximum latitude in the selection decision....

e. Techniques.

(2) When numerical evaluation techniques are used, summary scores for each proposal evaluated should be the mean of the scores of each evaluator assigned. Prior to such formal individual ratings, in-depth discussions among the evaluators assigned should be initiated to insure understanding and consideration of the relative merits of the proposal against the established technical requirements and criteria.

(3) Numerical scores may not convey fully the individual evaluator's judgment of some aspects of the proposal; therefore, each evaluator should supplement his rating with concise narrative evaluation which includes discussion and interpretation of the limitations of his rating.

USAMC Supplement 1 to AR 715-6
Procurement Proposal Evaluation and Source Selection
3 November 1970

Excerpts related to cost evaluation:

- AR 715-6, 21 September 1970, is supplemented as follows:

- Page 1, paragraph 3b. Additional specific objectives are:

(5) Insure increased weight is given to cost realism in proposal evaluation plans.

(6) Insure offerors are made aware that cost realism will be a major factor in the source selection.

- Page 4, paragraph 6c. Responsibilities/Source Selection Advisory Council:

(14) Insure that records of offerors past performance in cost estimating are used in determining the realism of cost estimates in current proposals.

(15) Insure that areas of contractor proposals that lack cost realism are thoroughly reviewed and clarified through negotiations by the contracting officer.

(16) Insure that the SSEB evaluates the results of negotiations to clarify lack of cost realism and includes such evaluation in its report.

(17) Insure that the SSAC analyses highlight the results of negotiation to resolve the lack of cost realism.

DARCOM Pamphlet 715-3
Proposal Evaluation and Source Selection
October 1980

Excerpts related to cost evaluation:

- Foreward

Although the provisions of this pamphlet are not mandatory, they are based on the latest experience in the use of organized proposal evaluation and source-selection procedures contemplated by AR 715-6, Proposal Evaluation and Source Selection. Mandatory instructions for proposal evaluation and source selection for major systems are contained in AR 715-6.

The proposal evaluation and source-selection process is dynamic and requires the exercise of judgment and experience throughout the process. As acquisitions vary in size and technical complexity, so do their requirements for proposal evaluation and source-selection procedures.... The Source-Selection Authority must choose the degree of application of these procedures, drawing on the advice of legal, contracting, and technical personnel.

- Chapter 1. Introduction

1-1 Purpose.... Ultimately, the source selection shall take into account the offerors capability to provide the Army with the best value.

1-3 Flexibility.

a. Tailoring.

(1) Due to the variety of circumstances that may be encountered, a static organizational structure, timetable, or detailed procedure is not practical or desirable.

- Chapter 2. Organizational Structure and Staffing for Proposal Evaluation and Source Selection

2-2 Tailoring an organizational structure.

a. The degree of technical sophistication as well as the dollar value of the acquisition are among those considerations that normally dictate the magnitude and configuration of the organization.

b. Every acquisition within the purview of this pamphlet goes through the same functional steps: evaluation, negotiation, selection, and award.

2-3 Basic organizational model.

b. SSAC.

(h) Insure that contractor performance history in the areas of technical, cost realism, and management is evaluated by the SSEB.

- Chapter 3. Evaluation and Selection Process

3-2c(11) Scoring procedures.

(a) The particular scoring system to be used in the evaluation is described in this portion of the plan. Of the several types available, including numerical, adjectival, or combination thereof, one must be chosen that is tailored to the requirements of the source selection under consideration.

3-6b(6) Evaluation requirements.

(b) Critical requirements must be explained in the RFP with considerable care. These requirements may relate to operational suitability, performance, management, schedule, cost, or other constraints that could finally determine whether the proposal is acceptable.

3-9a The principal purposes of proposal evaluation....

(2) Determine from among the proposals received (together with other factors bearing on the performance potential of each firm) which one provides the highest probability of achieving optimum satisfaction of the Government's objectives including technical, schedule, and cost performance.

(3) Provide a sound basis for the SSA to make an informed and objective selection by...(b) Identifying areas of uncertainty and risk as well as those in which there is substantial assurance of a successful outcome.

c. Proposal evaluation requires a mixture of factfinding, reporting, and the application of professional judgment to provide a rounded and comprehensive picture of the adequacy of each offer. This calls for:

(1) Validation of the representations, estimates, and projections presented in each proposal, particularly by comparison with independent Government estimates of performance, schedule, cost, and established requirements.

3-10a The component tasks of the evaluation vary in number, content, and sequence with each new source selection....

(3) Verification of judgmental aspects of a proposal....

(d) Another form of verification found useful is to cross-check major features in the technical proposal with related items in the cost proposal, management proposal, or time schedule.

(5) Scoring.

(a) Examining each proposal in detail to measure the predetermined elements, factors, and items against the established criteria--and assigning to them a score, numerical or otherwise--constitutes the core of the evaluation process. The effectiveness of prior planning and preparation becomes apparent at this critical stage of the proposal evaluation.

(b) Because numerical scores or other types of grading may not convey fully the individual evaluator's judgment of some aspects of the proposal, each evaluator must supplement his rating with a concise narrative evaluation which includes discussion and interpretation of the limitations of his rating. The narrative records what the contractor offered and how it met the established requirement, and it summarizes the strong and weak points of what the contractor has proposed. In instances where the contractor has failed to meet a critical requirement, the evaluator assesses what should be done to remedy the deficiency and what the impact of the deficiency (corrected or uncorrected) is on the overall proposal. The numerical and/or narrative evaluation should be supplemented with a risk assessment. This assessment states the level of risk inherent in the offeror ultimately achieving the capability that has been stated in the proposal.

(c) All errors, omissions, and deficiencies should be considered by the SSEB evaluator in determining the initial score to be given the criteria or factor for which he is responsible, unless they are so minor and readily correctable that his committee chairman approves discarding them for scoring purposes.

(7) Conducting the negotiations.

(a) Negotiations must be conducted with all offerors in the competitive range unless an exception or qualification of this requirement is made in the solicitation.

(b) Negotiations are generally conducted in order to come to agreement on such matters as cost or price considerations, incentive arrangements, special provisions to be incorporated in the contractual instrument or scheduling. Negotiations are also frequently required to resolve any errors, omissions, or deficiencies that were identified during the initial evaluation prior to establishment of the competitive range.

(d) All discussions or negotiations with offerors within the competitive range are conducted by the contracting officer. He is assisted by such technical advisors as he requires, including, in some instances, the specialists who are most familiar with what is needed to remedy errors and correct deficiencies.

(8) Best and final offers.

(a) At the end of discussions/negotiations, all offerors remaining in the competition range are provided one final opportunity to submit revisions which must be received by a common cutoff date. This last opportunity for revision is known as the best and final offer.

(9) Final evaluation by the SSEB.

(a) When the revisions to proposals, purporting to correct errors, omissions, and deficiencies, and when best and final offers are returned to the SSEB, those portions of the original proposal affected require reevaluation and rescoring. New scores are then computed and the relative standing of the competitors determined again.

(10) Summarization. After the various criteria are scored, the raw scores must be summarized. These scores are in diverse forms; ranging from qualitative assessments, to strengths and weaknesses, to go/no-go statements, to quantifications of adjectival ratings, to actual quantitative judgments of performance (i.e., 80 mph). In planning the source selection, the selection plan has developed provisions for efficiently summarizing this diverse material for ranking and ultimate source-selection decision. In turn, the SSAC must relate the evaluation criteria with weights, priority, or trade-off values, or by describing how judgmental decisions will be used to relate the raw scores to a summary level.

3-14 The source-selection authority.

c. In the evaluation and selection process, the selection official is not bound by the findings, scoring, and recommendations of lower level review bodies and officials. The only limits on the discretion of the SSA are that the selection must have a rational basis in terms of the evaluation factors in the RFP, and all the legal and procedural requirements of the evaluation process must be met (i.e., relative order of importance of factors in the RFP, competitive range, best and final offers, etc.).... The final decision should not be based upon numeric, adjectival,

or other scores, rather it should be based upon the relative strengths and weaknesses of the competing proposals.

3-17 Debriefing of competitors.

b. Debriefings are not intended to be a forum for debate, and the discussions should not include comparisons with other proposals but should be confined to the specific strengths and weaknesses of the individual proposal being considered versus the RFP requirements. An explanation of the evaluation method is appropriate to insure the unsuccessful firms that their proposals were treated fairly, impartially, and objectively, but it would be inappropriate to disclose specific criteria weights or the rating scores assigned to particular companies.

- Chapter 4. Special Evaluation Considerations

4-2 Considerations in selecting criteria.

a. Proposal evaluation in the DOD has often been plagued by seemingly insolvable recurrent problems. Probably the two most representative of these problems are the selection of the "wrong" offeror and the "dead heat." That is, in certain situations evaluators are driven by circumstances to recommend award to an offeror who does not have the best proposal and in other situations evaluators must give decisionmakers two or more proposals having virtually identical evaluation scores.

b. One major cause for these recurrent difficulties, particularly the first one mentioned here, is simply poor planning. The PM often expresses a general evaluation plan (evaluation factors and relative weights among them) without anticipating any problems. However, when the proposals are received, evaluators may find that as a result of their plan, they have scored highest a proposal that is really not the best, or that they cannot discriminate among proposals; as a result they are in a "box." In this situation, the PM has told the offerors the evaluation rules and then finds it difficult to live with the results of the evaluation. They can amend the solicitation to change the evaluation information to what they should have originally had in mind to discriminate the "best" proposal, but this is costly, time-consuming, and may draw charges of favoritism and bias. They can resolicit the acquisition and endure an even longer, more costly, and perhaps even more challengeable evaluation. They can go ahead with the evaluation, suggest award to the "wrong" offeror or change the evaluation "rules" *de facto* and award the "right" one and in either case suffer a true loss of objectivity and a very real threat of a protest. The alternatives in any case are not good.

c. The best way to avoid this classic dilemma is to spend more time on evaluation planning. The PM must realize the first attempt at an evaluation plan may not always achieve desired results. Evaluation factors should be studied and chosen with great care.

4-3 Structuring the evaluation matrix.

b(1) ...Three major areas that have been considered more or less traditional in source selection are: technical, cost, and management; however, there is nothing sacred in such a division. Other areas for considerations are: logistics, operational suitability, test and evaluation (T&E), etc. The evaluation areas, even at the major or rollup level, must be specifically tailored to each program, and the needs of the

Army which that program is seeking to satisfy.

4-4 Relationship of the criteria.

a. General. Relativity of each criterion to the total mission requirement must be established in order to summarize the scores. The decisionmaker may do this by weighing the criteria, by priority or trade-off statements, by judgmental decision rules, or a combination of these. Weighting would involve an assignment of relative importance among the criteria by breaking up a constant sum (typically 100 or 1,000 points). (See DARCOM Procurement Instruction 3-501 for weighting information to be given in the RFP.) For source officials who do not want specific numerical relationships, the criteria may be related by priority statements and the scores combined by judgment using these priorities rather than by numeric formulas using weights. For example, in a priority statement "cost" may be said to be slightly more important than "management" but slightly less than "operational suitability." A decision rule would tell how to deal with a factor under varying conditions. For example, a decision rule might be "if management is rated anything less than satisfactory, the entire proposal is unacceptable," or "if the proposed price is 30-percent higher than the Government estimate, it will be judged as being potentially unrealistic, the cost score will be penalized, and the technical proposal will be reevaluated to see if there is some misunderstanding of the requirements." In order, then, to provide a base for the evaluation, a precise definition of each established criterion must be prepared in narrative form to indicate what it is and how it is to be used, and a description of the alpha or numeric standard indicating the desired performance for each major element, and the relationship among factors and subfactors. Definitions should be either included in, or appended to the selection plan.

b. Weighting guidance.

(1) In the process of source selection, a weight is a gauge of the relative importance of all the areas, elements, and factors that are used in evaluating a proposal. Weights applied by the SSAC to the scoring process may be numerical, adjectival, or narrative. One must be alert to the fact that numerical scoring systems do not insure mathematical certitude. Overreliance upon arithmetic summarization could lead to an incorrect decision based on the tabulations of numerous decisions scored by the individual evaluators. Although the individual scoring (i.e., evaluation of the proposal at element and factor level) may be quite accurate and acceptable by themselves, it is inevitably tied to a system that has been designed in gross and is, therefore, fallible.

(2) A wide range of criteria, many of them highly specialized, must be identified, reviewed, and evaluated in a major acquisition.... Each procurement is unique in itself, and the various evaluation elements and factors are of greater or lesser importance in each case....

(3) After choosing the critical, discriminating criteria evaluators (and/or evaluation decisionmakers) must decide how they truly feel about the relative importance among the areas or they may later be awarding to the "wrong" offeror. A very common example here is having to decide between an offeror who offers more performance but at a high price and an offeror who offers marginally acceptable performance but at a very attractive price. In situations of low technical risk, one might decide the latter offeror could handle it and save the Government some money. In

situations of high technical risk, a decisionmaker may decide it was worth the money to award to the first offeror who is more likely to succeed. In either situation, the decisionmaker may be thwarted because improper weighting has "driven" the decision to the wrong offeror. An excellent high-performance (but high-cost) proposal may be favored but have to be passed up because cost was weighted too high. On the other hand, a technically acceptable (but marginal) proposal with an attractive price may be favored in other circumstances but lost to the decisionmaker because performance was weighted too high.

(4) Regardless of the weighting system used, it is essential that the distribution of weights bear a discernable relationship to valid identifiable and defensible needs of the acquisition....

(7) The relative importance of weights is established by the PM in the plan in a form for use in the proposal solicitation. Weights must not be altered once the proposals have been received, unless an SSAC approved amendment to the solicitation is issued.

(a) The simplest, and the most commonly used method is weight assignment by percentage distribution, whereby weights may be distributed to the major areas or elements based on 100 percent. Within each of the areas, a 100-percent distribution may be employed again to fix the relative importance of each element. If desired, this technique may be carried down to the factor levels....

(b) Sound contracting policy requires that prospective offerors be given enough information regarding evaluation factors and their relative weights to permit them to prepare their proposals properly. Nonetheless, the disclosure of exact numerical weights could create an inflexible situation which might rigidify the contractor's input to the detriment of its overall quality, and deny to the SSA the measure of discretion that he needs to protect the Government's interest. Therefore, the RFP should make abundantly clear to the prospective contractors those areas requiring special emphasis, without at the same time, disclosing the exact numerical weights.

4-5 Scoring.

a. The actual evaluation of proposals is accomplished by individual evaluators judging the merits of each criterion identified for evaluation contained in the contractor's proposal versus the Government standards to the lowest level of detail. From this point forward, until the results of the detailed evaluation have been submitted to the SSAC, the scoring process is simply a tabulation of factors, elements, and major area scores into a composite score at final summarization level. As an additional point of reference, a contractor's proposal is evaluated by comparing specific parts of the submitted data against standards/requirements; not by comparing the element in the various contractor's submissions with each other. The numerical, adjectival, or other designator developed to express how well the standard has been met is known as score, or rating.

b. The most frequent used rating procedure in proposal evaluation is the numeric method. Scores are normally based on a preestablished scale from 0 to 10. It is required, however, that each numerical score be accompanied by a supporting narrative signed by the evaluator and discussing strong and weak points which were considered in the scoring. Reports of intermediate groups which send forward composite scores should

be accompanied by a narrative analysis which takes into account both the numerical scores and the individual narratives.

c. Adjectival scoring is often employed and particularly in connection with numerical ratings. Where this is done, it is customary to establish adjective scoring standards in advance, for the purpose of having the same set of values used by all evaluators in arriving at their independent judgments. A typical numerical-adjectival combined rating matrix is shown below.

<u>Score</u>	<u>Evaluation</u>
10	<u>Excellent</u> --(innovative, comprehensive and complete in all details, meets all requirements and objectives without gold plating).
9	<u>Very Good</u> --(substantial response in clearly definable detail, meets all critical requirements).
7	<u>Average</u> --(generally meets minimum requirements).
6	<u>Poor</u> --(lack of essential information to substantiate data presented).
5	<u>Unsatisfactory</u> --(lack of understanding of requirements or omissions in major areas).
0	<u>No Data</u> .

d. If attendant numerical scoring is not practical, and no weighting factors are to be applied, only the adjectival ratings above can be utilized.

e. Narrative ratings may be used by themselves, or combined with numerical scores when the weighting factor is to be applied. When a scoring type of narrative is used to support an adjective rating, it should be based on the same criteria as the adjective rating and should explain the basis for either high or low scores.

f. Graphic or charting techniques, with color coding, are used to reflect relative conclusions and are particularly effective for briefing purposes. Necessarily a graphic display must be supported by a related narrative presentation. Graphic evaluation at the lowest level is not suggested, but is particularly effective at the summation or rollup level.

h. Regardless of the scoring procedures used, once established, they must be impartially applied by the evaluators to each proposal. Any departure from the established norms that are prompted by judgment factors outside the procedure is proper, only insofar as the same treatment is extended on an impartial basis to all qualified proposals and within the limits of the guidance given the proposers in the RFP.

i. Proposals should be evaluated as submitted; however, errors, omissions, and deficiencies are handled according to methods described in paragraph 3-10a(4).

4-6 Special factors.

a. In every selection proceeding, it is expected that there will be factors that require appraisal, which either do not fit neatly into the

typical pyramidal evaluation structure, or have special rules for their use. Among these are the evaluation of life-cycle costing, human factors engineering, and the ratio of lowest dollar per technical quality point.

(1) The evaluation of proposer life-cycle cost.

(d) The decision to use life-cycle cost criteria in source selection must be made during the acquisition/contracting planning phase. It is undoubtedly difficult to define, quantify, and measure many of the operating and support costs that must be considered. In some selections, it may be impossible, impractical, or too costly to undertake the analyses needed to come up with data of sufficient reliability to be used as evaluation criteria.

(3) Evaluation of lowest dollar per technical quality point (\$/q.p). The concept of selecting the best technical proposal for the dollar is supportable by the dollar/technical point relationships. This factor can be determined by dividing the cost of the proposal by the total unweighted raw score developed for "technical." With the knowledge contained in the RFP that this relationship will be given consideration and will force offerors to tradeoff between cost and technical factors in order to prepare the best possible proposal at a fair and reasonable price, \$/q.p. relationship by itself is not justification for selection; but is only considered an additional factor to offer to the SSA in making his decision.

4-7 Summary.

a. ...Weighting is a key to obtaining the desired results of an evaluation and source selection. It is, however, difficult to apply when quantitative scoring is not used and the evaluation is accomplished on only a narrative basis. The true strengths and weaknesses of a proposal can be clearly revealed by a narrative evaluation which sets forth the proposal's strengths and weaknesses. In the absence of a numeric score, the application of a numeric weight becomes extremely difficult. Therefore, a judgmental conversion of narrative score to numeric must be made before the numeric weight can be applied. Key narrative terminology of the raw score compared with numeral interpretation factors will provide the proper conversion.

b. Evaluators must avoid surprises by anticipating what might happen with various combinations of evaluation factors, weights, and types of proposals. In other words, evaluation planners can simulate their procurement by writing down the factors and weights they propose to use, making up simulated proposals, and evaluating these proposals against the tentative factors. Then it can be seen what kind of proposal is "favored," whether a winner can be discriminated, and whether the SSAC could adjust the factors and weights to achieve the kind of results they really want.

DARCOM-Circular 715-8-80
Procurement Instruction
9 October 1980

Excerpts related to cost evaluation:

- Appendix A, Section M. Evaluation Factors for Award.

(d) ...The following is an example of a provision relating to evaluation of cost:

EVALUATION OF COST. This element includes the evaluation of the target cost and target fee proposed by the offeror for performing all the requirements of the contemplated contract as set forth in this RFP. The evaluation will include an analysis of all costs proposed and submitted on DD Form 663 (Contract Pricing Proposal), together with all supporting cost information and data. The offeror's proposed costs will be evaluated by comparison with the Government cost estimate and by appropriate consideration of information from the Defense Contract Audit Agency, Government Technical Personnel, and other sources. The offeror's price will then be evaluated in accordance with its comparative advantage to the Government.

AF Regulation 70-15
Procurement Source Selection Policy and Procedures
16 April 1976

Excerpts related to cost evaluation:

- Table of Contents

This regulation implements DOD Directive 4105.62, 6 Jan 76, and is consistent with current systems acquisition/program management policies in AFR 800-2.

- Chapter 1. General Information and Policy

1-1. Applicability and Scope.

a. The source selection policies and procedures set forth in this regulation apply to the following competitive procurements:

(1) Each new development program estimated to require \$100 million or more RDT&E funds or projected to require \$500 million or more production funds (including support). These policies and procedures will be used to select the source(s) for the Advanced Development, Validation and Full-Scale Development contracts.

b. Policies and procedures contained in this regulation are sufficiently flexible to accommodate a wide range of requirements. They, therefore, may be used as a guide to formally evaluate competitive proposals and to select sources for other programs/projects below the dollar thresholds prescribed above. In this context, these procedures should be tailored to individual program/project requirements and selectively applied to avoid excessive costs.

1-2. Objectives. The prime objectives of the process of proposal solicitation, evaluation and source selection are to select the source whose proposal has the highest degree of realism and creditability and whose performance is expected to best meet Government objectives at an affordable cost; assure impartial, equitable, and comprehensive evaluation of competitor's proposals and related capabilities; and effect maximum efficiency and minimum complexity of proposal solicitation, evaluation and the selection decision.

1-3. Explanation of Terms.

j. Evaluation Criteria. The standards used in the Source Selection process to measure proposal acceptability in regard to the Government requirements stated in the Request for Proposal.

1. Independent Cost Estimate (ICE). The Government's cost estimate used for program approvals, for establishing budget estimates, and as a baseline for evaluating offerors' proposals. The ICE should be an independent, objective, unbiased estimate, which stands on its own as a "yardstick" for evaluating offerors' proposals. The full spectrum of quantitative tools and techniques should be brought to bear in developing the ICE.

m. Life Cycle Cost. The total cost of an item or system over its full life. It includes the cost of development, acquisition, ownership (operation, maintenance, etc.) and where applicable, disposal (see AFR 800-11).

n. Most Probable Cost (MPC). The Government estimate of the total cost most likely to be incurred by each of the competing offerors if a contract is awarded.

ad. Source Selection Process. The formalized process employed in competitive, negotiated procurements (other than for proposed awards to be based primarily on price competition) for programs/projects as defined in paragraph 1-1. The source selection is designed to insure an impartial, equitable, and economic, evaluation, and comparative analysis of competing offerors' proposals and their capabilities. This process provides an objective basis for the SSA to select the source(s) which best satisfies the Government's requirements.

1-4. Policies.

d. The source selection process shall focus adequate attention on the program risk and uncertainties during solicitation, proposal evaluation, and selection phases.

(1) Offerors should not be penalized for the identification of risk associated with their proposals. Proposals should be credited when realistic approaches for risk resolution are provided.

(2) The procuring activity shall prepare an independent risk assessment before receipt of proposals, to facilitate risk analysis evaluation.

e. The solicitation document shall identify areas of potential high technical and manufacturing risks when there is reason to believe that the risks are not generally known to the offerors. Offerors will be required to identify the risk associated with their proposals in the areas of cost, schedule, or performance, together with realistic approaches for resolving or avoiding the identified risks (including backup development efforts).

f. The solicitation document will encourage identification of potential trade-offs across the spectrum of design, development, production and operational and support. All new major defense systems will include appropriate design-to-cost goals. These goals must be clearly defined in the solicitation document and must be consistent with the total cost approach so as to encourage trade-off between acquisition cost and life cycle cost (reliability, maintainability and other logistics cost).

i. Evaluation criteria....

(1) The specific evaluation criteria must be included in the solicitation document and enumerated in terms of relative order of importance of those significant factors which will form the general basis for proposal evaluation and selection/contract award.

(3) The solicitation shall advise each potential offeror that his proposal is presumed to represent his best efforts to respond to the solicitation, and any apparent inconsistency between promised performance and cost or price should be explained. Further, any significant inconsistency, if unexplained, raises a fundamental issue of the offeror's understanding of the work required and/or of his ability to perform the contract and may be grounds for rejection of the proposal, or a basis for determination of nonresponsibility. The solicitation shall also advise that the burden of proof of cost credibility rests with the offeror.

j. The rating system or techniques to be used in evaluating and analyzing proposals, shall be set forth in the Source Selection Plan for approval by the SSA. The rating system shall be structured to enable the

SSA to identify the significant differences, strengths, weaknesses, and risks associated with each proposal and subsequent definitized contract.

n. The rating system may be entirely narrative, or may employ numerical scoring and weights or a descriptive color code in conjunction with narrative assessments (ref para 3-10). The important task in either rating system is the integrated assessment of all aspects of the evaluation, analysis, and negotiation process.

q. Continued effort must be exerted to achieve greater cost realism in proposals for major development programs. In order to achieve this objective:

(1) The preparation of Independent Cost Estimates (ICE), along with the use of most probable cost projections are to be used during source selection to assess cost realism during the evaluation of offerors' proposals.

(a) As a matter of policy, however, release of Independent Cost Estimates (ICE) is not advisable, as the recipient may pass the information on to companies that will, in effect, be offering against the ICE.

(b) The extent to which such a transmission of data will encourage unsubstantiated reductions in pricing proposals on the part of those contractors is difficult to predict, but the incentive is clear.

(2) Auction techniques (indicating to an offeror a price which must be met to obtain further consideration, or informing him that his price is not low in relation to that of another offeror) are strictly prohibited. On the other hand, this does not prohibit pointing out price or cost elements that do not appear to be justified, or encouraging offerors to put forward their most favorable price proposals; but in so doing the price elements of any other offeror must not be discussed, disclosed, or compared.

(3) When a cost/price proposal appears to be unrealistically high or low, a special assessment shall be included in the SSAC analysis report and an oral briefing prepared addressing the rationale for the apparent unrealistic cost/price. As prescribed in ASPR 4-106.4(c), a proposal may be penalized in this special assessment to the degree that the proposed cost/price is unrealistically low.

1-6. Organization.

d. (1) Due to the competitive environment in which discussions are conducted during the proposal evaluation and source selection period, offerors may tend to accept deficiency notifications as being a mandatory requirement to change their proposal.

(a) Each offeror must be informed that deficiencies are presented as advisory guidance only and it is at his election whether or not to make a change in the proposal. He does not have to agree with the Government.

(b) In pointing out deficiencies, the Contract Definitization Team will not suggest ways of improving the proposal, since offerors shall not be given the benefit of Government assistance which other offerors in the competitive range do not need or otherwise receive.

e. In discussing costs/prices, the Contract Definitization Team should recognize that under the constraint of competition, over-zealous cost/price discussions may cause offerors to lower their costs/prices to a point where, if accepted, could place the program in financial jeopardy even

before work is begun. Government negotiators must not lose sight of their own independent cost estimates, most probable cost estimates, and other techniques used during these discussions which help to determine cost realism. While it is imperative that unrealistically low or high cost elements be properly investigated and discussed, there is no intent that the discussion should lower a price to a point that it is unrealistic through the pressures of competition.

1-8. Determination of Competitive Range, Conducting Written or Oral Discussions, and Deficiency Resolution.

e. All offerors determined to be in the competitive range and selected to participate in oral or written discussions must be advised of any deficiencies in their proposals, and offered a reasonable opportunity to correct or resolve the deficiencies. Offerors must submit such price/cost, technical, or other proposal revisions as may result from the discussions.

(1) For the purpose of conducting discussions with offerors determined to be within the competitive range, a deficiency is defined as any part of an offeror's proposal which would not satisfy the Government's minimum requirements as stated in the solicitation document.

f. (4) When Contracting Officers call for the "best and final" offer, offerors should be cautioned against buying-in and submitting unsupported changes in their former offers. This can be accomplished by referencing ASPR 1-311 and the appropriate provision of the solicitation document which establishes the relative importance of cost in the evaluation process.

- Chapter 2. The Source Selection Process

2-2. Source Selection Plan.

b. (6) Evaluation of Costs:

(a) Identify those items of the system or subsystem (Military Procurement Code, Work Breakdown Structure) for which costs will be evaluated. Such items as overhead that are considered to have sufficient cost impact to warrant special consideration will be separately identified. Provisions for economic fluctuations and the rationale for estimating anticipated price level changes will be included, so that cost estimates can be evaluated in both base year and then year price levels. Items that are cost related and have an economic impact on the program but which are not quantifiable will also be identified. Plans for the use of in-house configurations or designs in developing the ICE should also be presented.

(b) Outline the steps to be followed to formulate the Government's best estimate of the total cost to the Government. This will include the methodology, scope, and data to be used in preparing the independent cost estimate and how it will be used in evaluating the offerors' proposals.

2-4. Solicitations.

a. (6) Unrealistically low estimates, initially or subsequently, may be grounds for eliminating a proposal from competition either on the grounds that the offeror does not understand the requirement or that the offeror has made an improvident proposal. The burden of proof of cost credibility rests with the offerors. If it is determined that an offeror's estimates are unexplainably low, that offeror may be eliminated from the competition (subject to the requirements of ASPR 3-805). Notice to this

effect should be set forth in the solicitation.

d. Offerors will be required to identify the risk associated with their proposals in the areas of technical, cost, schedule, or performance, together with realistic approaches for resolving or avoiding the identified risks (including backup development efforts). Risk analysis is a part of the evaluation process, and risk assessments for each proposal must be included in all reports to the SSAC and SSA....

- Chapter 3. Evaluation and Comparative Analysis

3-1. General.

b. ...The techniques of evaluation and analysis will vary with the acquisition approach employed and the specific requirements of the program, which may be to procure an end item, a design, a technical approach, or a design team effort.

c. Depending on the objectives of the procurement, the source selection process must be sufficiently flexible to accommodate these requirements. This will require that the approach to source selection and the development of the evaluation criteria be tailored to the specific needs of whatever is being procured under the contract.

3-2. Evaluation Criteria.

a. (3) The evaluation criteria contained in the solicitation must set forth the relative importance among technical, costs (development versus production versus operational and support costs), schedule, management and other factors as set forth in the Source Selection Plan. In the event that requirements or conditions significantly change so as to negate or modify the evaluation criteria originally established in the solicitation, the SSA shall ensure that each potential offeror is informed by the PCO in the form of an RFP amendment of the adjusted criteria and basis for award, and that sufficient time is provided for modification to the initial proposal.

b. (1) The policy emphasizes that the evaluation criteria should be tailored to the characteristics of a particular program/project and should include only those significant aspects which will have an impact on the ultimate selection decision.

(2) ...The approach should be one of selectivity in developing realistic, pertinent, and significant criteria which, when applied, will highlight the strengths, weaknesses, and risks of each proposal.

3-3. Specific Evaluation Criteria (Areas and Items).

c. (2) Through experience the most orderly breakout of areas is as follows: technical, operations, logistics, management/production, and costs. This exact structuring is not mandatory in all cases and should be adjusted to accommodate the specific requirement.

g. In each source selection there are certain characteristics which must be evaluated. These are:

(1) degree of technical risk contained in the offeror's proposal;
(2) the confidence that the Government can place in the offeror's cost proposal; and

(3) the financial capability of the offeror in relation to the financial risk associated with the proposed task and type of contract proposed.

(4) The evaluation of these criteria requires subjective judgment

as they may not lend themselves to numerical scoring. However, they must necessarily be fully addressed in narrative form, both by the SSEB and the SSAC. Government confidence in offeror's cost proposal and his financial capability best lend themselves to evaluation under the cost area which is not to be scored numerically. They must, accordingly, be addressed in narrative form.

3-6. Evaluation.

d. The preparation of the evaluation analysis in narrative form is the most important aspect of the evaluation process.

(1) In preparing the narrative which communicates the evaluator's findings to the SSAC, he must understand that his narrative will prove the most useful, and usually the only means available to the SSAC to inform the SSA what a company offers and how well it met the established standards.

(2) It is not sufficient that the narrative states that something is good or inferior. The evaluator must indicate in the narrative what was offered; how it met the standard, or how it failed to meet the minimum requirements; what, in the evaluator's opinion, must be done to remedy the deficiency; and what impact (including technical and cost risk) the deficiency correction will have on the overall acceptability of the offeror's proposal.

(3) Clarity and brevity are the keys to successfully prepared narratives.

3-7. Assessment of Risk.

a. Identification and assessment of risk are essential parts of the evaluation process.

(1) Certain risks may be inherent in a program by virtue of the program objectives relative to the state of the art. Risks may occur as a result of a particular technical approach, manufacturing plan, the selection of certain materials, processes, equipment, etc., and as a result of the costs and schedules and economic impacts associated with those approaches.

(2) Additional risks become apparent when a given design approach results in marginal operational performance.

b. Certain risks may be known to exist in major programs at the time the solicitation is transmitted to industry. In this case, the SSEB and SSAC must not penalize proposals merely because of the existence of these particular risks.

(1) Standards prepared for the items and factors where known risks exist must be such that they can be used to measure acceptability of the proposed solution, rather than place undue emphasis on the existence of the risk.

(2) Measurement of acceptability must consider both the approach proposed, the alternatives available, and any backup solutions described in the proposal.

c. In the judgment and analysis of risks the evaluator must consider the probability of success and, in event of failure, what alternatives are available to overcome the risks. Further, the assessment must determine when success or failure will be apparent and the impact the correction will have at that point in time. In this case, examination of the alternatives available and the ability of the alternatives to meet the minimum

requirement must be analyzed and reported.

d. In order that proper consideration may be given to risk, the evaluation criteria for all programs must include overall risk assessment for each proposal as a rated item or area in the evaluation process. Areas of potential high risk must be identified in the solicitation when there is reason to believe that the risks are not generally known to the contractor.

e. The offerors must be required to submit a risk analysis as a part of their proposal which also identifies risk areas and which furnishes an insight to the evaluator as to how the offeror intends to resolve these risks and the alternatives to overcoming the high risk approaches.

(1) In order to aid the evaluator in performing the risk analysis, the procuring activity should prepare an independent risk assessment prior to receipt of proposals.

(2) The SSAC must include in its analysis report and presentations to the SSA, an assessment of the cost, technical, management, production, schedule and economic risks associated with each proposal. This assessment will be based on an evaluation of the offeror's risk analysis and an evaluation of the specific design proposed.

f. The technical risk may impact operational capabilities, program schedules, and costs/prices. It is imperative that these risk impacts on costs/prices be properly considered in the determination of most probable cost.

(1) It is the responsibility of the technical evaluation teams to insure that the cost team is informed of the risk area, and further, that the cost team is aided in arriving at a judgment of cost impact which may result therefrom.

(2) The impact of technical risk on costs/prices must be included in the SSAC analysis report to the SSA.

3-8. Evaluation of Costs/Prices.

a. The total elements evaluated in conducting an analysis of cost/price varies with each program/project. It is essential that the cost information included in the SSAC analysis report in narrative format and presentation to the SSA be in sufficient depth to support the selection decision. Costs will not be numerically scored.

b. Cost/price evaluations of proposals generally require the following:

(1) Assurance of comparability. Consideration must be given to variations in amount of Government-furnished property (GFP) or materials, use of Government-owned facilities and tooling, and all other inconsistencies before the offerors' proposals can be equitably evaluated.

(2) Verification of rates. This requires a determination that labor and overhead rates, and any special pricing factors are reasonable, allocable and consistent with satisfactory accounting and estimating systems. (Defense Contract Audit Agency (DCAA) and Contract Administration Office (CAO) personnel should be called upon to assist in making this determination.)

(3) Determination of cost/price realism. Cost/price realism will be judged by the use of cost/price analysis. Wide disparities must be analyzed, documented and reported in the analysis. Further measurement of cost/price realism will be made by comparing most probable costs with proposed cost/prices after considering the risk associated with the design

approach, and disposition of deficiencies. Full use should be made of the Field Price Analysis Report prepared by the Contract Administration Office under ASPR Section III, Part 8.

(4) Determination of cost impact as a result of deficiency disposition. After offeror responds to Government-identified deficiencies (that) have been analyzed, all cost/price impacts resulting therefrom should again be considered by the cost team in their determination of cost/price realism.

(5) Determination of cost/price risk. Based on the data developed above and the technical risk assessments for each proposal, evaluate the cost/price risk inherent in each proposal. To the extent practicable, the potential impact of the identified risk will be reflected in the SSAC Comparative Analysis Report.

(6) Development of cost track. The cost/price team should maintain a cost track to facilitate the understanding of various changes leading to the final cost/price review by the SSA. The cost track will be used for establishing a cost baseline for evaluating post contract award changes.

(7) Preparation of a special assessment for any cost/price which appears to be unrealistic. The assessment should address the reasons why the SSEB believes the estimate to be unrealistic.

3-10. Use of Rating or Scoring Techniques (as Applicable).

a. Having assessed the offerors' data and recorded the assessment of the factor or subfactor by means of a narrative as evaluated against the standard, it may be useful as an aid for evaluation to develop a quantitative rating which indicates how well the offerors' proposals as initially submitted met the minimum requirements expressed in the solicitation. This should be done prior to any action relative to correction of deficiencies.

b. It is not absolutely essential to score proposals if the items and factors being evaluated do not lend themselves to numerical scoring.

(1) For example, costs, financial capability, and other aspects of a contractor's management/production capability may not lend themselves to scoring.

(2) Costs in fact will not be numerically scored, and evaluation in narrative form in the management or production areas may be adequate to portray to the SSAC/SSA the significant strengths and weaknesses of each response in these areas.

h. Whether numerical scores and weights or color codes are employed, it must be recognized that they are communications techniques and are but one of the factors to be considered by the SSA in reaching his final selection decision. Their relative importance must be kept in proper balance with all other salient factors and must be fully supported with narrative rationale.

i. When numerical or color code scoring is employed, proposals must only be scored as originally submitted, to encourage the best initial submission from the offerors. Proposals must not be rescored as result of written or oral discussions. However, any changes from the original proposal should be identified in the discussion summary and analyzed for the SSA in the SSAC Analysis Report and oral presentation.

k. In order to maintain the integrity of the source selection and

ensure that the best proposals are submitted initially, numerical scores (if used) will be based on the original submission.

- Appendix. SSAC Proposal Analysis Report.

IV. Cost to the Government. The reasonableness, realism, and completeness of each contractor's proposal should be fully explained. This section normally includes data pertaining to the cost/price analysis, independent cost estimates, total costs to the Government, most probable cost, impact of technical uncertainty on cost/price, etc. This section will also include an explanation of the relative importance of costs in relation to other aspects of the program and any special assessments made in relation to unrealistic cost/price proposals.

VIII. Risk Analysis. Discuss the overall impact of all significant risks and/or "soft spots" associated with each proposal. These will include:

- a. Technical risks inherent in the offeror's proposal including technical capability (whether demonstrated or not);
- b. Confidence that can be placed in the cost/price estimate provided by each offeror considering technical risk;
- c. Schedule risk as assessed against the technical approach and the prevailing economic environment (material shortages);
- d. The financial risk to each offeror in relation to the type of contract and task involved; and
- e. Production risks relating to make-or-buy decisions, anticipated new manufacturing technologies, availability of production facilities, and overall production competence. Any design trade-offs made by the offerors and their impact on costs should also be discussed.

- Appendix. SSAC Presentation to Commanders, AF Council, Chief of Staff, Assistant Secretaries, and the Secretary.

d. Cost to the Government. This section of the presentation shows the cost/price as originally proposed, as adjusted for comparability; compares the ICE with adjusted cost/price; indicates most probable cost based on Air Force estimates and highlights major cost risks. Where major differences are apparent between offeror proposed and Air Force estimated cost, probable financial impact on the offeror is indicated.

f. Risk Analysis. This part shows an overall analysis, and the resultant impact of risks of each proposal. This should include the offeror's proposed solution to known risks, the impact of risks resulting from peculiar approaches chosen by the offeror, the impact these risks have on the program and associated costs/prices, and the financial risks to be taken by the offeror in relation to the type of contract as well as any overall risks to the program accrued through these risks.

Excerpts related to cost evaluation:

- Chapter 1. General Procedures and Guidance

1-1. Purpose and Objectives.

b.(2) Ensure that the source selection process is flexible enough to accommodate the objectives of both the R&D program and an appropriate contractual relationship. Ensure the acquisition approaches and procedures allow seeking the best scientific and technical sources which also results in an award with the balanced mix of performance, cost, and schedule.

c. The regulation addresses R&D procurements consisting of studies, projects exploring solutions for technical/scientific concepts, and programs requiring design and development of hardware items for test and experimentation. These procurements must be evaluated under the guidance of ASPR 4-106.4, which provides major emphasis to technical competence but requires consideration of all other pertinent factors including management capabilities, cost controls, and past performance in determining the offer selected for award.

1-2. Applicability and Scope.

a. This regulation is not intended for use on engineering development and production procurements.

- Chapter 2. R&D Acquisition Process

2-13. Technical and Business Evaluations.

b. While cost or price should not be the controlling factor in selecting a contractor for an R&D contract, they should not be disregarded in the choice of the contractor.

APPENDIX D

COST-BENEFIT ANALYSIS

A. INTRODUCTION

The purpose of this Appendix is to analyze the costs and benefits associated with applying the methodology described in this Handbook. In particular the costs and benefits of making cost realism an explicit evaluation criterion are addressed. Neither the costs nor the benefits can be readily measured. The principal costs associated with applying the methodology are the costs of preparing detailed Government estimates for each offeror. However, even if the methodology is not followed completely, some examination and evaluation of each offeror's proposed costs must be made. How much of the cost associated with proposal cost evaluation is related to cost realism or a full application of the methodology? The principal benefits associated with applying the methodology are possible reductions in cost growth and schedule slippage. But how are such benefits quantified? Although exact answers to these questions are difficult to determine, the following subsections try to place the costs and benefits into perspective.

B. COST REALISM COSTS

In a sense, all cost evaluations will address the realism or reasonableness of contractors' offers. However, if cost realism is made an explicit evaluation criterion, in an effort to encourage the contractors to make more realistic offers, then a more detailed cost evaluation is likely than otherwise. The key to assessing the realism and reasonableness of cost proposals is the development of a realistic Government cost estimate for each offeror, which can be compared against that offeror's proposed cost. This is termed the "Government estimated cost" or "Government estimate" in this Handbook. While a cost proposal can be analyzed and its realism judged on a piecemeal basis (e.g., examining a few major cost elements and commenting on the degree of realism), such an approach is

generally not sufficient. The Government should make an estimate of what it considers to be the most likely total cost for each offeror. Then the Government estimates can be compared to the offeror's proposed costs to determine the overall degree of cost realism and the Government estimates for each offeror can be compared to each other in order to rank the offerors in terms of the Government estimated cost. Therefore, the Government estimates themselves must be realistic and reasonable.

Developing Government estimates for each offeror requires a detailed analysis of direct and indirect costs. Direct costs are direct labor, direct material, and other direct costs which are specifically and uniquely attributable to a particular product or service. Direct costs are the "nucleus" around which total contract price is built since the indirect costs (overhead, G&A and fee) are generally a function of direct costs.

A methodology recommended for developing these estimates is as follows. The first step is an examination of the cost proposals and any backup data for completeness and consistency. Then, extensive "fact-finding" is conducted at the offerors' plants, where clarifications can be obtained, additional backup data examined, and the offerors asked to justify their cost estimates based on their actual experience on previous programs. Through such fact-finding, the validity and applicability of the offeror's data and estimating techniques can be determined. Alternatively, the offerors may be invited to Government offices to answer questions; but, without access to their complete data bases, the offerors are limited in the answers they can provide.

A number of costs are associated with source selection cost evaluation. These costs are primarily a function of the time spent by Government personnel. Each source selection organization includes a cost evaluation team that consists of several to a dozen or more personnel (generally cost and pricing analysts) depending on the size and complexity of the procurement, the number of offerors, and the depth of the cost analysis. These personnel are generally involved in the source selection nearly full-time for a period of one to a few months.

Therefore, the cost evaluation team may spend from a few man-months to 50 or more man-months. The cost evaluation team typically assists in preparation of the Source Selection Plan and the solicitation, prepares a detailed Government estimate which may include detailed fact-finding at contractors' plants, evaluates and scores the costs, and prepares appropriate documentation of their cost estimates and evaluation. Obviously, the cost evaluation can be done at many levels of detail and will generally be more detailed if cost realism is an evaluation criterion.

The amount of effort expended by cost evaluation teams indicated above of a few to 50 or more man-months is a very rough range. Information obtained from the Cost Analysis/Estimating Branch of NAVELEX (ELEX-82B) provides a better indication, although still rough. ELEX-82B has provided a major portion of the cost evaluation teams for a number of source selections. These source selections have included three or four RDT&E source selections per year for which cost realism was a specific evaluation criterion. The ELEX-82B staff of 9 to 12 people has spent approximately one-third to one-half of their time on these cost evaluations. Thus, on an average, each cost evaluation has involved somewhere between 10 and 20 man-months. At roughly \$4,000 per man-month, this is between \$40,000 and \$80,000. Travel associated with the fact-finding increases these costs by about 10 percent. Since the average contract value is about \$40 million, the average cost for each cost evaluation is between 0.1 percent and 0.2 percent of the contract value. For two of the most significant RDT&E cost evaluation efforts, ELEX-82B has made the following estimates: 18 man-months for the ASPJ and 24 to 27 man-months for the JTIDS. In each of these cases, the RDT&E contract was for about \$80 million. Based on \$4,000 per man-month, the costs associated with these cost evaluations were \$70,000 and \$110,000, respectively. In addition, travel costs associated with the fact-finding were roughly \$10,000 for each. Therefore, the cost evaluation team costs totaled approximately \$80,000 and

\$120,000 or 0.10 percent of the ASPJ contract value and 0.15 percent of the JTIDS contract value.

There are other costs than the cost evaluation team's time and travel associated with source selection evaluation. The team is assisted by various organizations including DCAS, DCAA and related organizations. The source selection technical evaluation team may also assist the cost evaluation team. In addition, the offerors may spend time answering questions and supplying additional data, particularly during the fact-finding meetings. In some cases, these other costs will be significant, and may even double the costs mentioned above if DCAS and/or DCAA are heavily involved in the cost evaluation.

The NAVELEX data therefore suggest that the costs associated with RDT&E cost evaluations for electronic systems, including DCAS, DCAA and other support, are typically 0.1 to 0.3 percent of the contract value. This includes the preparation of a detailed Government estimate for each offeror, fact-finding, and updating the estimate after best-and-final offers are received. Data were not available to determine whether the costs of aircraft, missile and ship cost evaluations are similar. These systems generally have larger RDT&E costs than electronic systems, and there is generally a lot more that has to be evaluated; but "economies-of-scale" probably come into play and fewer offerors may be involved. Therefore, it seems reasonable to assume that cost evaluations for larger systems will not exceed 0.1 to 0.3 percent of the contract value.

The above discussion provides some insights into the costs associated with RDT&E source selection cost evaluations. However, it is difficult to determine how much of this cost is associated with cost realism. Where cost realism is made an explicit evaluation criterion, as in the NAVELEX source selections discussed above, a more intense cost evaluation is probably performed. Certainly, some examination and evaluation of each offeror's proposed costs must be made, even if cost realism is not an evaluation criterion. Therefore, only a fraction of the cost evaluation team costs is attributable to cost realism.

C. COST REALISM BENEFITS

A major reason for the concern about cost realism is that it is undoubtedly a significant, but sometimes overlooked, factor in cost growth. Defense acquisition programs have long shown tremendous cost growth between their inception and fielding. Congress has expressed great interest in the subject of cost growth and, in November 1981, took the unprecedented step of requiring that Service Secretaries prepare a detailed report to Congress if cost growth on a major program exceeds 15 percent or face suspension of further obligations. If cost growth exceeds 25 percent, the Secretary of Defense must certify to Congress that the program is essential and that the new cost estimates are reasonable.*

The complexity and risks inherent in Defense systems make contractor cost estimation, not to mention Government review and evaluation of the costs, difficult. Some optimism may be warranted (e.g., in engineering hours required, in number of test articles, and in number of tests), but when does optimism become unrealism? In some cases, the contractor may purposely propose an unrealistically low cost in order to "buy-in" and thereby improve its business base and cash flow.

Unrealistically low cost estimates, both Government and contractor, contain the seeds for future cost growth. Low cost estimates may lead to under-budgeting and to schedule slips which in turn may introduce even greater costs than would have occurred with realistic budgets.

Cost growth means more than higher costs and possible schedule slips; it is also embarrassing, a factor the Nunn-McCurdy Amendment highlights. Cost growth may require drastic changes in system design and program scope. It may lead to program cancellation or to the cancellation of other programs in order to provide the required additional funds. And certainly, frequent cost overruns will undermine and eventually destroy

* The Nunn-McCurdy Amendment to the 1983 DOD Authorization Act.

public confidence in the Government's capability to manage its programs.

Of course, the Government must also guard against unrealistically high cost estimates. This situation will most probably occur if there are few technically qualified contractors and if a contractor already has an especially good business base. High cost estimates do minimize the likelihood of an overrun, but the Government could probably have bought the system for less.

Some indication of the degree of cost realism in contractors' cost proposals and the possible extent to which the cost realism methodology results in more realistic offers is provided by data collected from NAVELEX on proposed costs for eight programs and the corresponding Government estimates. In developing the Government estimates, NAVELEX evaluated the contractor cost proposals in detail, required the contractors to justify their data and estimating rationale, developed their own estimates based almost entirely on the contractors' data, and compared these estimates with the cost proposals. The data showed that one out of three original offers was more than 20 percent low, and one out of six best-and-final offers was more than 20 percent low. Offers more than 20 percent below the NAVELEX estimate certainly raise a question as to cost realism. Interestingly, less than one-quarter of the original offers but nearly half of the best-and-final offers were within 3 percent of the NAVELEX estimates.

In summary, then, if greater cost realism can be achieved in contractors' cost proposals through application of the methodology described in this Handbook, or through any other means, some of the likely benefits (not necessarily mutually exclusive) are:

- Reduced cost growth,
- Reduced incidence of "buy-ins",
- Reduced under-budgeting,
- Reduced schedule slippages,
- Reduced program turbulence resulting from the above factors,

- Reduced possibility of major redesign, scope changes and program cancellations,
- Fewer reports to Congress under the Nunn-McCurdy Amendment, and
- Reduced costs in situations where an offer is unrealistically high, but due to other considerations that offeror wins the competition.

This list of benefits is not meant to imply that cost realism is a magic elixir, but these benefits can be achieved in some measure. After all, contractors' cost proposals can often be more realistic than they are now; in many cases, both the data base and the tools exist for contractors to make more realistic estimates.

The cost realism benefits mentioned above are not easily quantified. However, it is possible to give some notion of the possible reduction in cost growth and the dollar value of reduced schedule slippage.

First, the possible reduction in cost growth is discussed. The improvements between initial offers and best-and-final offers noted in the NAVELEX data presented above were apparently largely the result of the detailed Government cost evaluation and the fact that cost realism was an evaluation criterion. Low initial offers came up an average of 9 percent in the best-and-final offers (e.g., from 20 percent below the Government estimate to 11 percent below). While this result is not entirely due to the application of a cost realism methodology by NAVELEX, the cost realism methodology was undoubtedly a major factor. Application of the cost realism methodology gives offerors an incentive to be more realistic through the scoring mechanism and the fact that very unrealistic offers may be the basis for disqualification. These data as well as intuition suggest that the cost realism methodology may result in offers (at least best-and-final offers) which are more realistic, as measured by the Government estimates, by 10 percent and even considerably more.

Now the possible reduction in program costs due to reduced schedule slippage is discussed. Suppose a five year development program stretches to a six year program due to funding problems and program turbulence created by significant cost growth. Certain program costs are of a fixed or level-of-effort nature, such as program management costs, and are more a function of time than a function of the technical tasks to be performed. Assume that the RDT&E program is estimated to cost \$20 million per year for five years--a total of \$100 million--and that 10 percent or \$2 million per year is fixed. A program stretch to six years will add \$2 million to the total program cost--even more if the variable (non-fixed) costs cannot be easily rescheduled (e.g., certain engineers might have to be kept on the program longer or alternatively might have to be terminated and replacements hired). The added \$2 million due to the one year schedule slip adds two percent to the total program cost. A six month stretch would add one percent. This probably understates the impact of schedule slips since many activities and personnel cannot be easily rescheduled as suggested above. Schedule slips can be expensive and unrealism in costs can certainly lead to schedule slips. A contract award to an offeror who is unrealistic by 20 percent compared to a Government estimate could very well result in a program having only 80 percent of the budget it needs and a program slip of a year or so by the time additional funding is made available. Therefore, in a situation like this, if the offeror is encouraged to make a more realistic offer, it is reasonable to assume that several percent of the program cost* can be saved.

D. CONCLUSIONS

A methodology has been developed for assuring greater cost realism in contractors' RDT&E proposals, based largely on techniques and procedures developed by NAVELEX. Key aspects of this

* The estimated program cost if there had not been a schedule slip.

methodology are (a) establishing cost realism as an explicit cost evaluation criterion in the solicitation, (b) preparing a detailed Government estimate for each offeror based largely on the offeror's own data, and (c) scoring the degree of cost realism. While the costs and benefits associated with applying this methodology are difficult to quantify, this appendix has tried to place the costs and benefits into perspective. Unrealism in cost proposals often contributes to cost growth, which may lead to program turbulence and schedule slips. Program costs may increase by at least several percent over what the program would have cost had an award been made at a realistic cost and budgeted accordingly. On the other hand, the costs associated with source selection cost evaluations, only part of which can be specifically attributed to the cost realism evaluation criterion, are probably less than a few tenths of a percent of the program cost.* Therefore, on the basis of this rough cost-benefit analysis as well as the intangible benefits which have been identified, there appears to be ample justification for greater attention to cost realism in the source selection process.

If desired, a somewhat less rough cost-benefit analysis can be performed than was possible in this Appendix. For example, the size and schedule of the cost evaluation team will be known or can be estimated for the specific program. Also, an approximate cost of the specific program will be known or can be estimated. Further, it may be possible to determine approximately how a contract award well below the likely cost of the program will affect the program budget and schedule as well as what impact a schedule slip would have on level-of-effort costs. However, even without performing a cost-benefit analysis for

* The costs associated with a cost evaluation are incurred during the source selection process whereas any cost savings attributable to cost realism would be realized during the course of the RDT&E contract. Therefore, to be more accurate, the cost savings should be discounted. Since the quantification of the costs and benefits in this report is very approximate, no discounting was done.

each specific source selection, there appears to be ample justification, tangible and intangible, for applying the methodology in this Handbook.

APPENDIX E

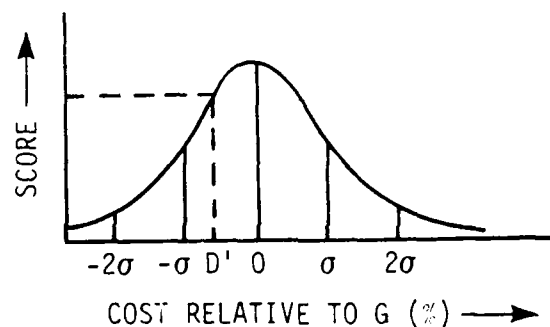
NORMAL CURVE SCORING RULE

As mentioned in Section VIII, various smooth curves can be used as scoring rules. A normal curve is a particularly convenient form of a smooth curve. The parameters of a normal curve can be chosen such that a normal curve scoring rule closely approximates a triangle or trapezoid scoring rule. The advantage of a normal curve scoring rule is that it does not have sharp discontinuities as do the triangle and trapezoid. However, the normal curve scoring rule is not as easy to explain and understand. Furthermore, a normal curve is generally associated with statistical probabilities or with uncertainties--connotations which are not appropriate in this case. Therefore, the discussion in Section VIII assumed a triangle or trapezoid scoring rule. Since some readers of this Handbook may prefer the normal curve scoring rule, this Appendix provides a discussion.

Normal curve scoring rules are discussed below first for cost realism and then for Government estimated cost.

A. COST REALISM

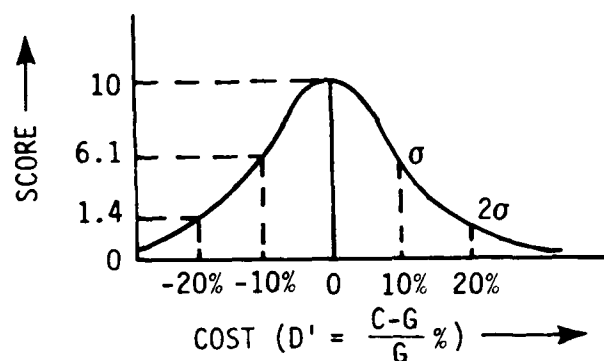
The normal curve scoring rule for cost realism is a "bell" shaped curve whose "spread" is determined by the normal curve standard deviation, σ , as shown below:



D' is the offer (C) relative to the Government estimated cost (G) in percentage terms or $(C-G)/G$ %. There is a 68 percent

likelihood that D' will be less than σ , and a 95 percent likelihood that D' will be less than 2σ (i.e., 68 percent of the area under the curve is within σ of the mode, and 95 percent of the area is within 2σ). The standard deviation is used here to define the spread of the scoring rule and does not necessarily have a statistical significance.

In order to use the normal curve scoring rule for cost realism, two values must be determined--the maximum score and the "spread". It is convenient to set the maximum score at 10. For triangle and trapezoid scoring rules, the spread is defined as the point at which the score becomes a minimum. For the normal curve, the spread can conveniently be defined as 2σ . For example, if $2\sigma = 20$ percent of G , then an offer 10 percent higher or lower than G would receive a score of 6.1 and an offer 20 percent higher or lower would receive a score of 1.4. This is illustrated as follows:



The equation for the scoring rule is:

$$\text{Score} = 10e^{-(\frac{C-G}{G})^2/2\sigma^2} = 10e^{-D'^2/2\sigma^2}$$

By coincidence, normal curve and trapezoid scoring rules with the same spread ($2\sigma = S$) closely approximate each other (assuming the trapezoid plateau is $0.1S$ and the minimum score is 1 at S). This is illustrated in Figure E.1.

The normal curve scoring rule has the following desirable properties. First, it is a smooth function which can be expressed by an exponential equation as given above. Once plotted for

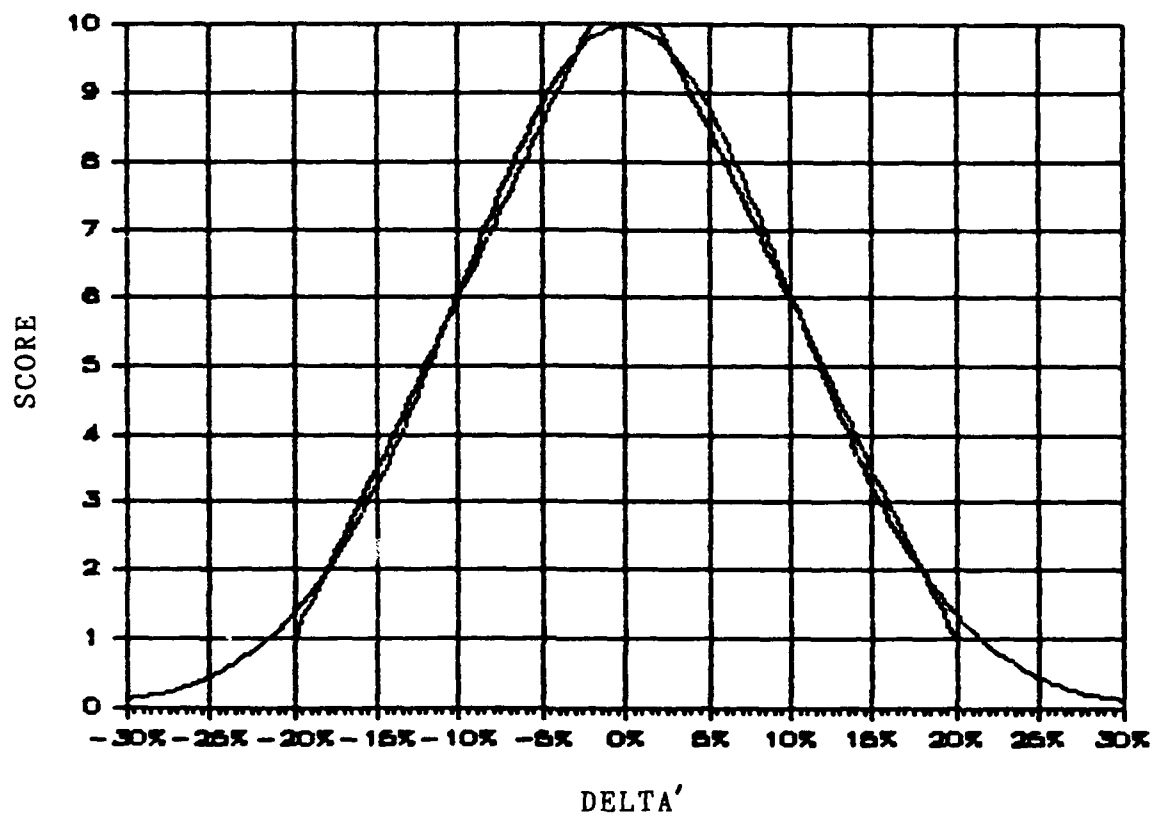


Figure E.1 Cost Realism Scoring Rule Comparison

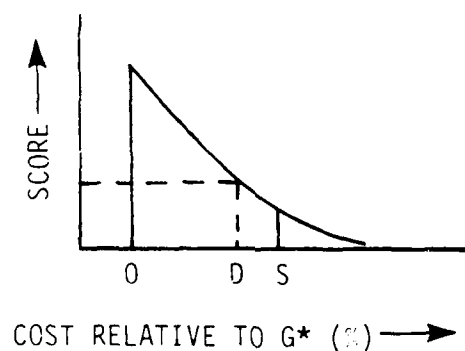
any value of 2σ , the normal curve is easy to use; just figure D' and then read off the score.

Second, offers close to the Government estimate have approximately the same high score and offers far from the Government estimate have approximately the same low score.

Third, and most importantly, since the spread (2σ or S) is arbitrarily chosen for any program and a greater or lesser spread may in fact be more reasonable, it is desirable that, as the spread changes, the scores change with a minimum of distortion. The triangle and trapezoid scoring rule can lead to greater distortions than the normal curve scoring rule. This is indicated for the trapezoid in the table on the following page. For example, as a result of a change in S from 15 to 20 percent, the second offeror's score increases by 2.5 points relative to the third offeror, if the trapezoid scoring rule is used. However, if the normal curve scoring rule is used, as 2σ changes from 15 to 20 percent, the second offeror's score increases by only 0.8 points relative to the third offeror. Figure E.2 further illustrates this problem with the trapezoid scoring rule.

B. GOVERNMENT ESTIMATED COST

A Government estimated cost scoring rule using part of a normal curve is illustrated below:



D is the Government estimated cost (G) relative to the lowest Government estimated cost (G^*) in percentage terms or $(G-G^*)/G^* \%$. In order to more closely approximate a triangle scoring

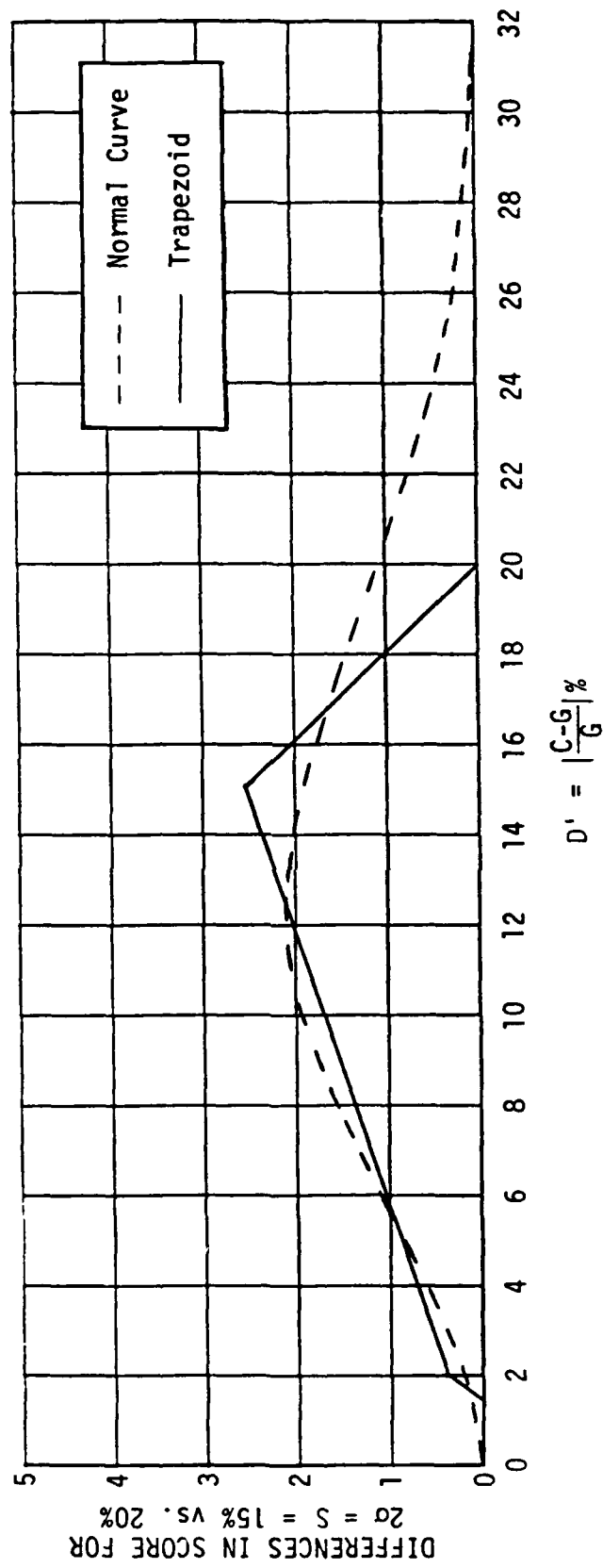
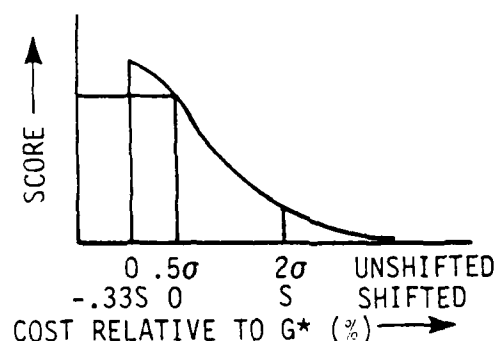


Figure E.2 Differences in Scores for Different Spreads

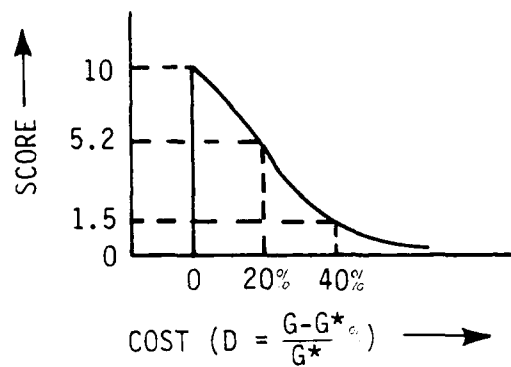
SCORES FOR DIFFERENT VALUES OF S AND 2σ

Offeror Spread	A 10%	B 15%	C 20%	D 25%
Trapezoid* S = 15% S = 20% Difference	4.3 6.0 <u>1.7</u>	1.0 3.5 <u>2.5</u>	1.0 1.0 <u>0</u>	1.0 1.0 <u>0</u>
Normal $2\sigma = 15\%$ $2\sigma = 20\%$ Difference	3.9 6.0 <u>2.1</u>	1.4 3.3 <u>1.9</u>	.3 1.4 <u>1.1</u>	<.1 .4 <u>.4</u>

rule, this normal curve scoring rule has been shifted as illustrated below:



To use the normal curve scoring rule for Government estimated cost, two values must be determined--the maximum score and the "spread". (The amount of the shift could also be varied.) As for cost realism, it is convenient to set the maximum score at 10. The spread, S, is defined for convenience as 2 (see the above illustration). For example, if $S = 40$ percent of G^* , then an offer 20 percent higher than G^* would receive a score of 5.2 and an offer 40 percent higher would receive a score of 1.5. This is illustrated as follows:



The equation for the scoring rule is:

$$\text{Score} = 11.33e^{-\left(\frac{G-G^*}{G^*} + \frac{S}{3}\right)^2 / 0.889S^2} = 11.33e^{-\left(D + \frac{S}{3}\right)^2 / 0.889S^2}$$

A normal curve and triangle scoring rule with the same spread closely approximate each other. This is illustrated in Figure E.3.

The normal curve scoring rule has the same advantages for Government estimated cost as for cost realism.

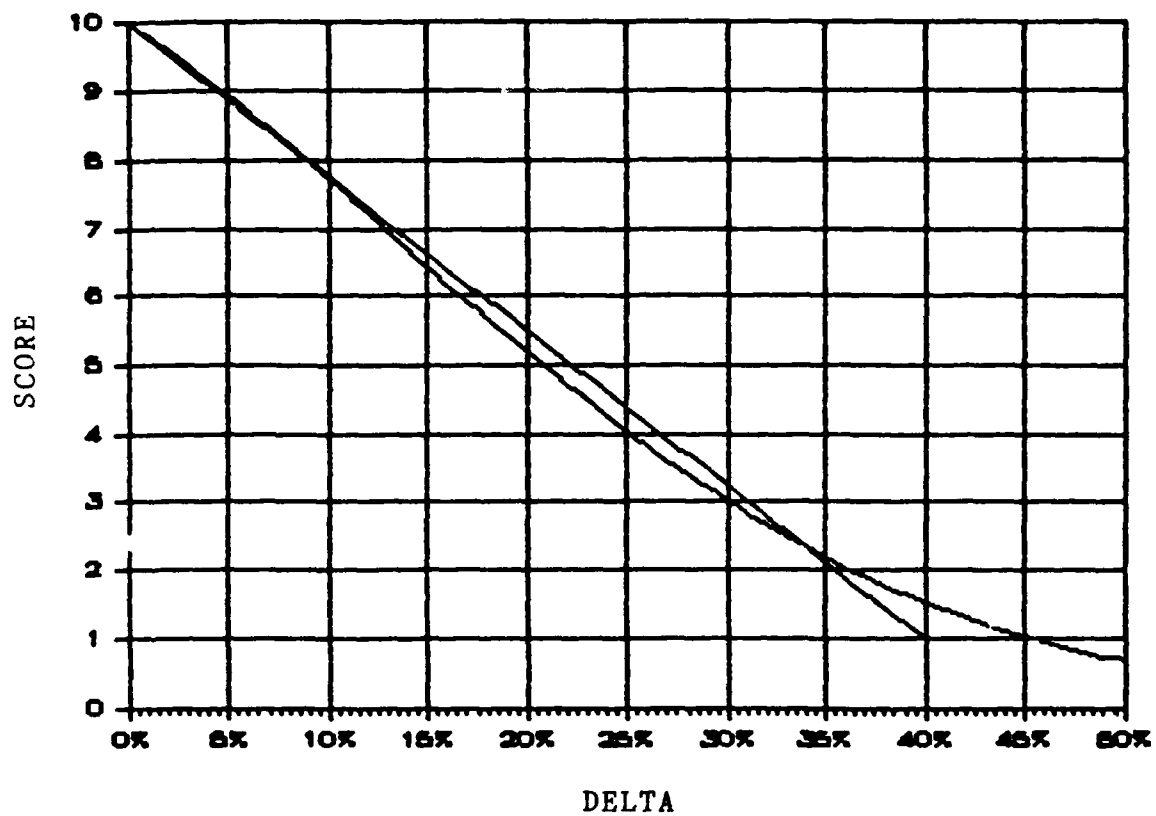


Figure E.3 Government Estimated Cost Scoring Rule Comparison

APPENDIX F

COST REALISM COMPUTER MODELS

A. INTRODUCTION

Two computer models have been developed to assist source selection personnel in evaluating cost proposals. The first model is a "cost evaluation scoring model" for generating numerical scores for cost proposals. The second model is a "cost evaluation tradeoff model" for determining the tradeoffs between cost evaluation scores and technical scores. Both models, but especially the latter one, can assist source selection personnel in establishing the shape of cost evaluation scoring rules and the weights to be assigned to cost evaluation criteria.

The scoring methodology that underlies these models is explained in Section VIII of this Handbook. Two versions of each model have been developed; one version is based on a trapezoid shaped scoring rule, and the other version is based on a normal curve scoring rule. (Trapezoid shape as used in this Appendix also includes triangle shape.) The two versions produce very similar results. The following discussion applies to both versions, except that the "top" spread and minimum score apply only to the trapezoid version. Tables and figures follow the text and are based on the trapezoid version since it is easier to understand. However, examples of the normal curve version are presented in Subsection D.

B. SCORING MODEL

Main Scoring Model

An illustrative scoring model run is shown in Table 1 and corresponds to the illustrative example in Section X. Boxes are drawn around the inputs that are required--on the screen, the cells requiring inputs are highlighted. Two cost evaluation criteria are assumed--Government Estimated Cost and Cost Realism. The Government Estimated Cost is evaluated on the basis of the percent difference between the Government Estimated

Cost for a particular offeror and the lowest Government estimate for all of the competing offerors (Delta). Cost Realism is evaluated on the basis of the percent difference between each offer and the Government Estimated Cost for that offeror (Delta'). The "base" spread is the Delta or Delta' at which the scoring rule assigns a minimum score. The "top" spread is typically 10% of the base spread; and the minimum score is typically "1". A choice is given of entering the weights or weight ratios; whichever is entered, the other is automatically calculated.

Once the spreads, weights, offers and Government estimates are entered, then Delta, Delta', cost evaluation scores and weighted scores are calculated, as illustrated in Table 1. The degree of technical advantage that an offeror would have to have over the offeror with the highest cost evaluation weighted score in order to equalize their total weighted scores is also shown (the range results from the assumption that the technical scores may be between 70 and 100% of the maximum technical score). The sensitivity of the scores to a difference of plus or minus 2% in the Government estimate is also shown.

When the scoring model is loaded, a "blank" table is displayed with zeros or "errors" shown for the input values. The illustrative example in Table 1 may be quickly loaded into the model as indicated on the second page of the table. Six different graphs of the scores may be quickly displayed on the screen. The graphs for the above illustrative example are displayed in Figures 1 to 6. Instructions for printing the table and the graphs are provided on the second page of the table.

Sensitivity Scoring Model

The above table and graphs represent the "main" scoring model [SCTRAP]. There is a second part to the scoring model [SCTRAP/2] which provides a sensitivity analysis of the spreads and weights. Two different spreads and two different weights (or weight ratios) are entered into the "sensitivity" table. Three different graphs, showing the sensitivities, may be

quickly displayed. This part of the model is illustrated in Table 2 and Figures 7 to 9.

Comparison Scoring Model

There is also a third part to the scoring model [SCCOMPT] which provides a comparison of scores for three cases with different spreads and weights. Note that the second and third parts of the model are different ways to look at the effect of spreads and weights on the scores. The three cases are entered into the "comparison" table. Two different graphs may be quickly displayed. The comparison part of the model is illustrated in Table 3 and Figures 10 and 11. Note that this illustration has the same weights in all three cases. Another illustration of the comparison model with different weights, but with the spreads the same in all three cases, is provided in Table 4 and Figures 12 and 13. These two runs of the comparison model illustrate the effect on scores of a broad range of values for the spreads and weights.

Studying Tables 3 and 4 and their associated graphs (together with the illustrative tradeoff model runs discussed in Section C) can provide a lot of help in establishing spreads and weights to be used for a particular source selection evaluation--without necessarily having to actually run the model.

It should be noted that the the scoring model can only accomodate five offerors. If there are more than five offerors, additional runs of the scoring model will have to be made. The offeror with the lowest Government estimate must be repeated in all runs. Tables and graphs with all offerors can then be prepared manually.

C. TRADEOFF MODEL

The tradeoff model [TRDTRAP] is illustrated in Table 5. Boxes are drawn around the inputs that are required. As many as three sets of spreads and three sets of weights may be input to the model. However, a single set is sufficient to run the

model. The most challenging inputs required in the table are the values for the indifference envelopes (these envelopes are discussed in the "Cost Realism Handbook"). The indifference envelope for the Government Estimated Cost is that range of costs that one would be willing to accept for a particular technical advantage. The indifference envelope for cost realism is that range of unrealism that one would be willing to accept for a particular technical advantage. The indifference envelopes can be entered as percentages or dollars for three different technical advantages. If the approximate cost of the program is specified, then dollars will automatically be calculated if percentages are entered, and vice versa. Once the spreads, weights, and envelopes are entered, the tradeoffs are calculated.

When the tradeoff model is loaded, a "blank" table is displayed with zeros or "errors" shown for the input values. The illustrative example in Table 5 may be quickly loaded into the model as indicated on the first page of the table. Fourteen different graphs of the tradeoffs may be quickly displayed on the screen. The graphs for the above illustrative example are displayed in Figures 14 to 27. Note that starting with the "blank" table, just the illustrative indifference envelopes may be quickly loaded into the model. Instructions for printing the table and the graphs are provided on the second page of the table.

The tradeoff model run in Table 5 illustrates the effect on tradeoffs of a broad range of values for the spreads and weights--the same broad range used for the comparison scoring model runs in Tables 3 and 4. The technical weights are held constant at 60 (out of 100) in Table 5, and the total cost evaluation weights (Government Estimated Cost plus Cost Realism) are held constant at 30. Therefore, a further illustration of the tradeoff model is provided in Table 6 and Figures 28 to 33 with the technical weights varied from 50 to 75 and the total cost evaluation weights varied from 20 to 35.

Studying Tables 5 and 6 and their associated graphs, together with the illustrative scoring model runs in Tables 3 and 4, can provide a lot of help in establishing spreads and weights to be used for a particular source selection evaluation without necessarily having to actually run the models.

D. MISCELLANEOUS

Lotus 1-2-3

The scoring model and tradeoff model have been developed using the Lotus 1-2-3 integrated software program. The Lotus program is one of the most popular and widely used spreadsheet/graphics programs. It runs on an IBM PC with 196K of memory, as well as a number of other micro-computers. The models could be readily adapted to other spreadsheet/graphics programs by users, if necessary. Two advantages of Lotus and similar integrated programs are the ease of displaying graphs and the ease of making modifications.

To use one of the models, Lotus 1-2-3 is loaded into the computer along with a data disk containing the model. There are separate data disks for the scoring and tradeoff models. Copies of these special data disks may be obtained from the Navy Office of Acquisition Research.

Normal Curve Scoring Rules

As mentioned at the beginning, two versions of the models have been developed--a trapezoid scoring rule version which has been used for the above tables and figures and a normal curve scoring rule version. The scoring rules are compared in Figures 34 and 35. The two versions produce very similar results. Normal curve scoring rules are discussed in Appendix E. An illustrative normal curve scoring model run is presented in Table 7 and Figures 36 and 37. This example is identical to that presented in Table 1, except for the use of a normal curve. Comparisons between the trapezoid and normal scores in Table 1 and 7 are shown in Figures 38 and 39.

An illustrative normal curve tradeoff model run is presented in Table 8 and Figures 40 to 43. This example is identical to that presented in Table 5, except for the use of a normal curve.

E. INFORMATION FOR USERS OF THE MODEL

The several models and their names are shown in the table below. Associated files are also indicated.

Model Type	Model Name	Data Disk	Example File ("ALT X")	Envelopes File ("ALT V")	Blank File ("ALT Y")
Trapezoid Shape:					
Main Scoring	SCTRAP	A	XT	-	YT
Sensitivity	SCTRAP/2	A	UT	-	VT
Comparison	SCCOMPT	A	XTC	-	YTC
Tradeoff	TRDTRAP	B	XT	V	YT
Normal Curve Shape:					
Main Scoring	SCNORM	A	X	-	Y
Sensitivity	SCNORM/2	A	U	-	V
Comparison	SCCOMPN	A	XC	-	YC
Tradeoff	TRDNORM	B	X	V	Y

The models are loaded as follows. With the Lotus 1-2-3 disk in Drive A and the scoring model or tradeoff model data disk in Drive B, boot the system. If the system is already booted and the system prompt "A>" is displayed, type "123" and "enter". When the blank spreadsheet appears, type "/FR" and select the appropriate model by moving the cursor over the model name and pressing "enter". Each of the model tables provides most of the information needed to run the models. The key information is summarized in the next paragraph. Additional information is provided in subsequent paragraphs.

When using the models, it should be noted that after entering or changing data in a table it is necessary to press the "F9" key in order to perform a recalculation. DO NOT FORGET! Graphs are displayed or "invoked" by simultaneously pressing the "ALT" key and a special letter key, as explained in each input table. To clear a graph from the screen and return to an input table, it is necessary to press a key (any key).

When changing from entering weights as whole numbers to entering as ratios, or vice versa, first return to a "blank" table. This may be accomplished using "ALT" Y, which replaces the weight computational formulas.

A "circular" error will sometimes be displayed by Lotus 1-2-3. This will occur with a "blank" table or when not all of the weight input cells are filled-in and is not a cause for alarm.

In using the models, there may be occasion to save a table with values filled in. In this case be sure to save the table using a different name.

Also, on occasion the user may want to modify the model in some ways. Changes may not be made, except for the highlighted input values, unless the cell protection feature is disabled by using "/WGPD". Protection may be turned back on using "/WGPE".

A listing of the computer model data input cells and equations for SCTRAP and TRDTRAP are provided in Tables 9 and 10. As mentioned earlier, data disks for use with LOTUS 1-2-3 may be obtained from the Navy office of Acquisition Research (address on cover).

Table 1.

COST EVALUATION SCORING MODEL--TRAPEZOID SHAPE

[SCTRAP]

ENTER: SPREADS AS DECIMALS

----- WEIGHTS AS WHOLE NUMBERS -OR- ENTER WEIGHT RATIOS AS DECIMALS

SPREAD:	BASE	TOP	MIN SCORE
GOV'T EST COST	40.0%	0.0%	1]
COST REALISM	20.0%	2.0%	1]

WEIGHT:			
TECHNICAL (T)	60.0]		
GOV'T EST COST (E)	20.0]	AFTER ENTERING OR CHANGING DATA,	
COST REALISM (R)	10.0]	PRESS "F9" TO RECALCULATE	
OTHER	10.0]	-----	
TOTAL	100.0]		

WEIGHT RATIO:		
E/T	33.3%]	
R/T	16.7%]	
E/(E+R)	66.7%	
R/(E+R)	33.3%	

OFFEROR	OFFER (C)	GOV'T EST (G)	(G-G*)/G* (DELTA)	(C-G)/G (DELTA')	-----SCORES-----	
					GOV'T EST	REALISM
A	47.0	48.0	0.0%	-2.1%	10.0	10.0
B	47.0	54.0	12.5%	-13.0%	7.2	4.5
C	53.0	50.0	4.2%	6.0%	9.1	8.0
D	60.0	65.0	35.4%	-7.7%	2.0	7.2
E	89.0	70.0	45.8%	27.1%	1.0	1.0

OFFEROR	GOV'T EST	REALISM	WEIGHTED TOTAL	SCORES----- % OF MAX	TECH ADV LOW	TRADEOFF HIGH
A	20.0	10.0	30.0	100%	0%	0%
B	14.4	4.5	18.9	63%	23%	26%
C	18.1	8.0	26.1	87%	7%	9%
D	4.1	7.2	11.2	37%	45%	45%
E	2.0	1.0	3.0	10%	82%	82%

OFFEROR	-----DELTA RANGE (+/- 2%)-----		---GOV'T EST COST---		---COST REALISM---	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
A	0.0%	2.0%	-0.1%	-4.1%		
B	10.5%	14.5%	-11.0%	-15.0%		
C	2.2%	6.2%	4.0%	8.0%		
D	33.4%	37.4%	-5.7%	-9.7%		
E	43.8%	47.8%	25.1%	29.1%		

OFFEROR	-----SCORE RANGE-----		---GOV'T EST COST---		---COST REALISM---		WEIGHTED SCORE RANGE	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
A	9.6	10.0	9.0	10.0	28.1	30.0		
B	6.7	7.6	3.5	5.5	17.0	20.8		
C	8.6	9.5	7.0	9.0	24.2	28.0		
D	1.6	2.5	6.2	8.2	9.3	13.1		
E	1.0	1.0	1.0	1.0	3.0	3.0		

Table 1 (con't)

QUICK ENTRIES:

TO LOAD COMPLETE EXAMPLE, PRESS "ALT" KEY AND "X" SIMULTANEOUSLY
TO RETURN TO BLANK ENTRY FORM, PRESS "ALT" KEY AND "Y" SIMULTANEOUSLY

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY
----- (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
(TO RETURN TO THE WORKSHEET, PRESS "Q")

	GOV'T EST	REALISM	WEIGHTED
SCORE	A	B	C
RANGE	D	E	F

PRINT TABLE: PRESS "ALT" KEY AND "P" SIMULTANEOUSLY

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "S", AND
TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
(I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
NAME FOR EACH GRAPH--FOR EXAMPLE, A1, B1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

SENSITIVITY ANALYSIS: GO TO NEXT PART

Figure 1.

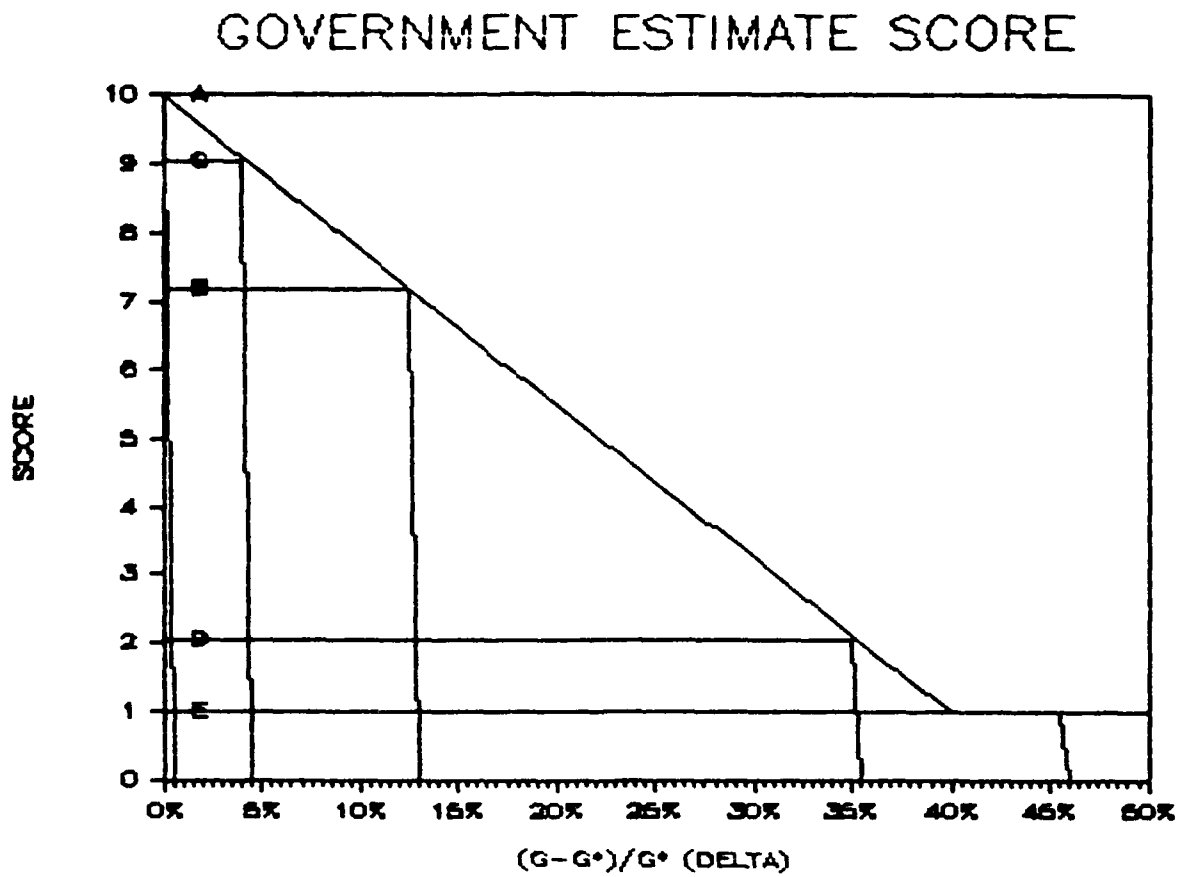


Figure 2.

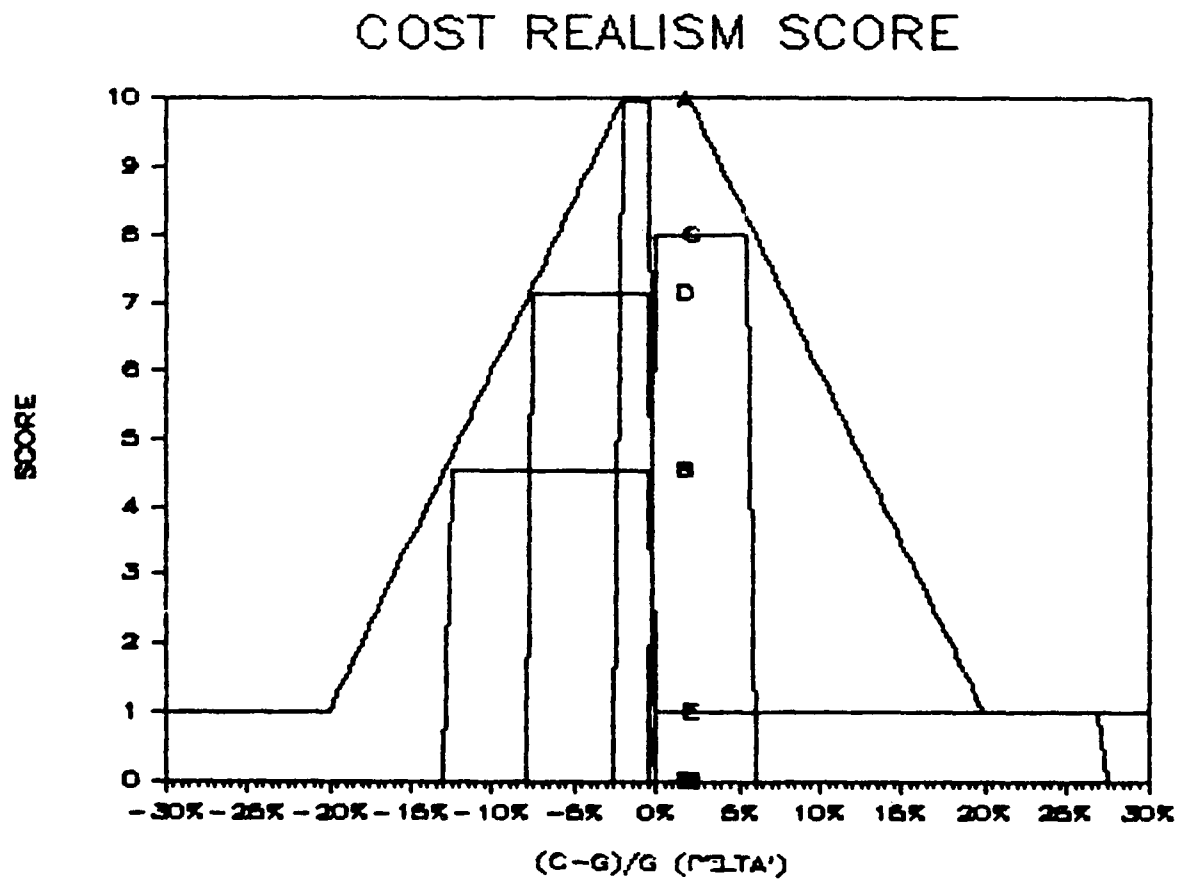


Figure 3.

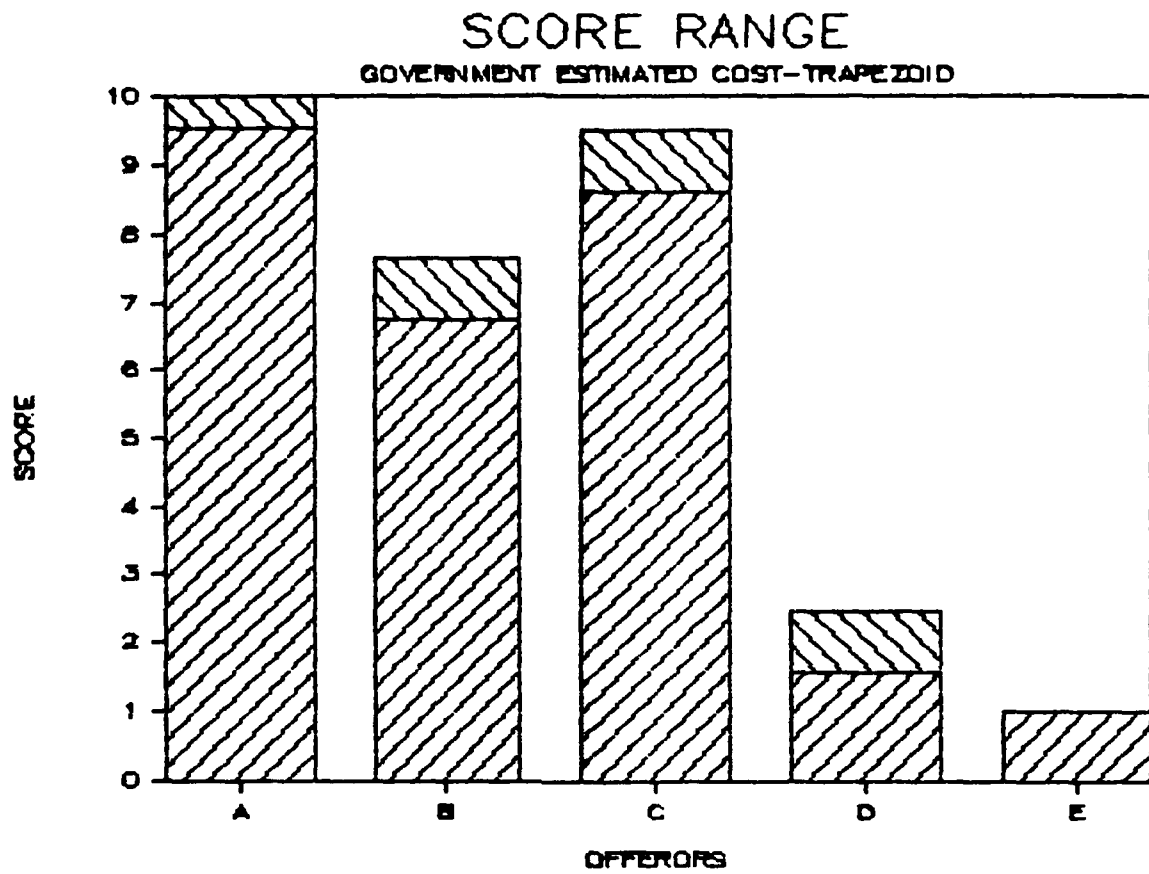


Figure 4.

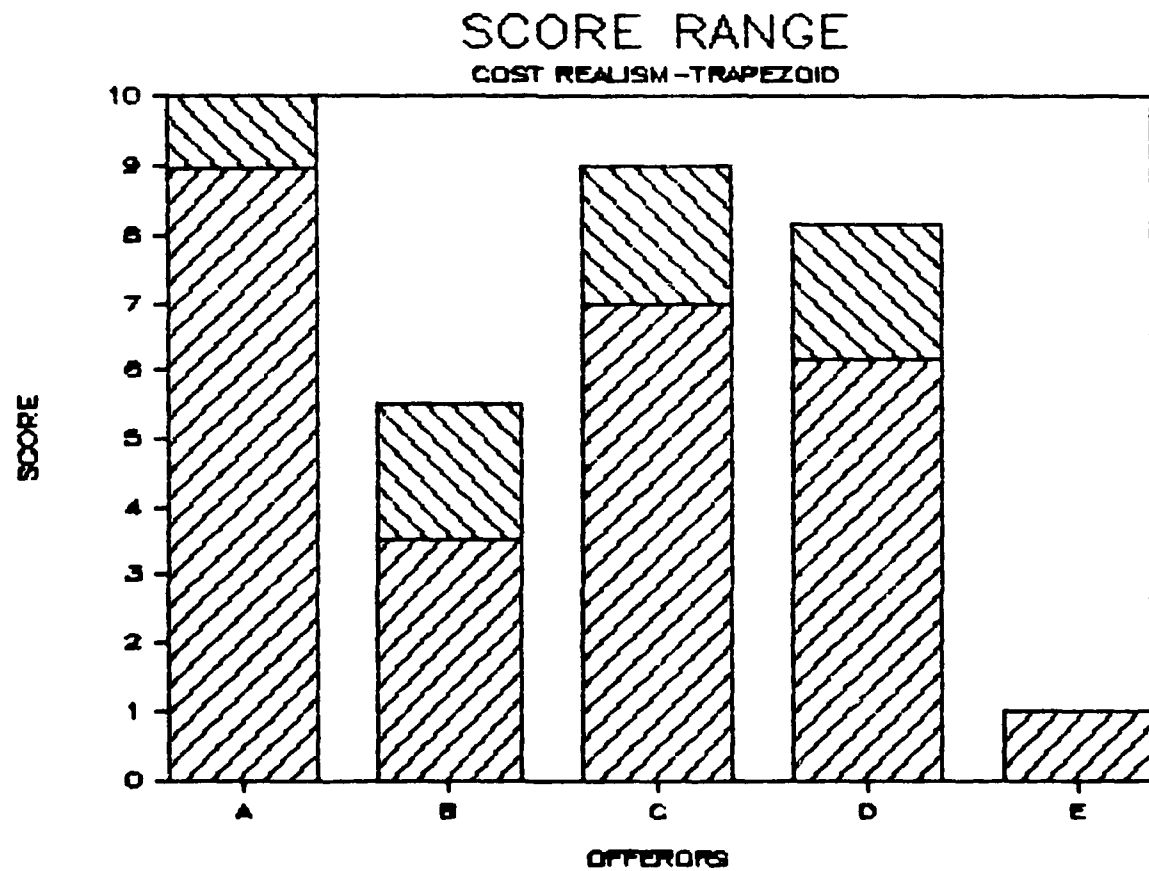


Figure 5.

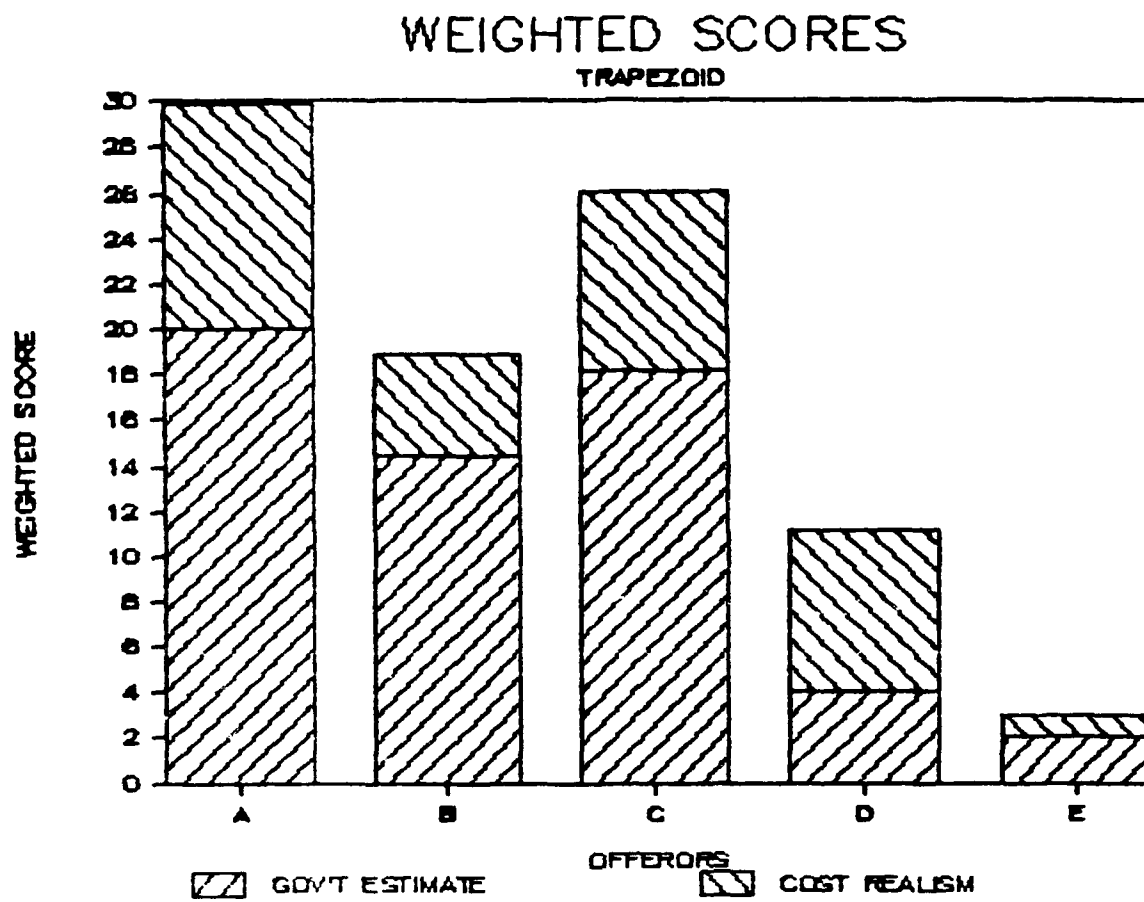


Figure 6.

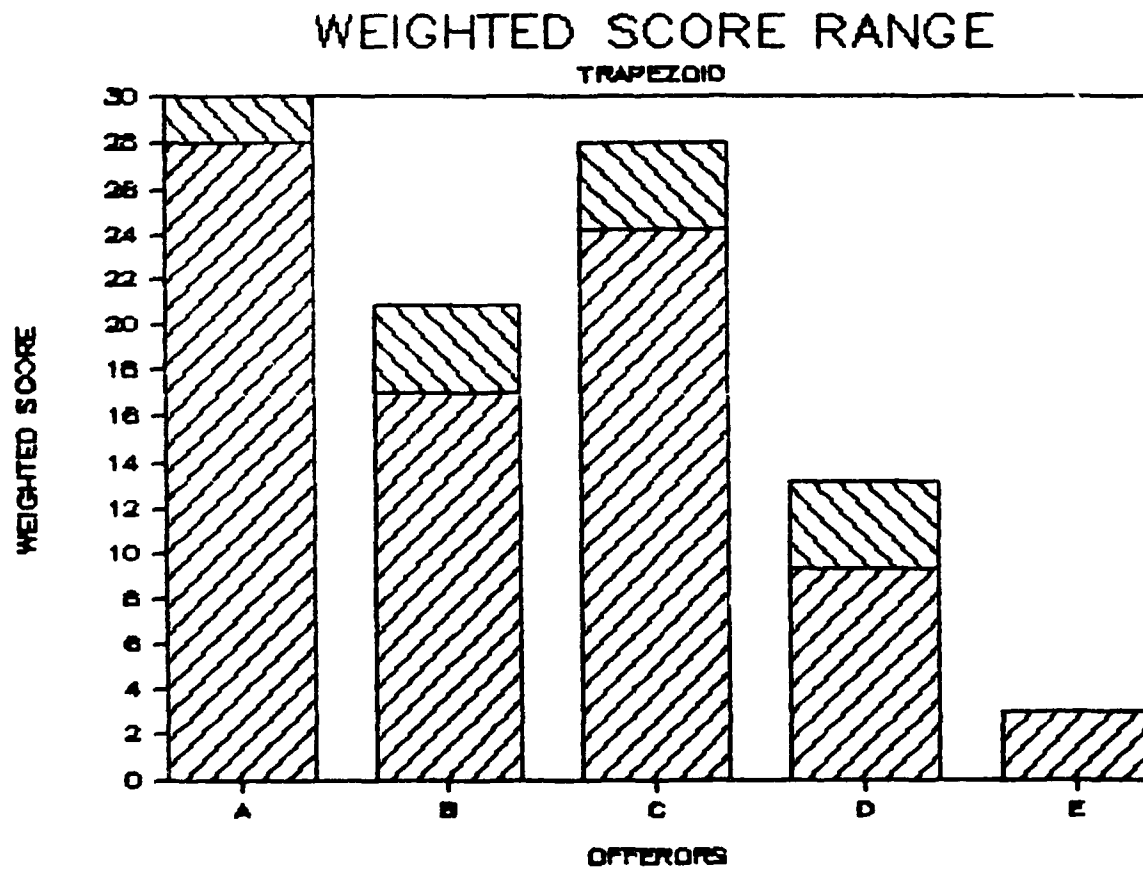


Table 2.

SCORING SENSITIVITY TO SPREADS AND WEIGHTS--TRAPEZOID SHAPE [SCTRAP/2]

ENTER SPREADS AND WEIGHTS

SPREAD:	-----BASE-----		-----TOP-----		MIN SCORE
	1ST	2ND	1ST	2ND	
GOV'T EST COST	40.0%	30.0%	0.0%	0.0%	1
COST REALISM	20.0%	15.0%	2.0%	1.5%	1

WEIGHT:	A	B	
TECHNICAL (T)	60.0	60.0]
GOV'T EST COST (E)	20.0	15.0]
COST REALISM (R)	10.0	15.0]
OTHER	10.0	10.0]
TOTAL	100.0	100.0]

WEIGHT RATIO:			
E/T	33.3%	25.0%]
R/T	16.7%	25.0%]
E/(E+R)	66.7%	50.0%	
R/(E+R)	33.3%	50.0%	

AFTER ENTERING OR
CHANGING DATA,
PRESS "F9" TO
RECALCULATE

SPREAD SENSITIVITY (WITH WEIGHT "A");

OFFEROR	-----SCORES-----			
	---GOV'T EST---		---REALISM---	
SPREAD	1ST	2ND	1ST	2ND
A	10.0	10.0	10.0	9.6
B	7.2	6.3	4.5	2.4
C	9.1	8.8	8.0	7.0
D	2.0	1.0	7.2	5.9
E	1.0	1.0	1.0	1.0

OFFEROR	-----WEIGHTED SCORES-----					
	---GOV'T EST---		---REALISM---		---TOTAL---	
SPREAD	1ST	2ND	1ST	2ND	1ST	2ND
A	20.0	19.9	10.0	9.6	30.0	29.5
B	14.4	12.5	4.5	2.4	18.9	14.9
C	18.1	17.5	8.0	7.0	26.1	24.5
D	4.1	2.0	7.2	5.9	11.2	7.9
E	2.0	2.0	1.0	1.0	3.0	3.0

WEIGHT SENSITIVITY (WITH 1ST SPREAD):

OFFEROR	-----SCORES-----	
	GOV'T EST	REALISM
A	10.0	10.0
B	7.2	4.5
C	9.1	8.0
D	2.0	7.2
E	1.0	1.0

Table 2 (con't)

OFFEROR WEIGHT	-----WEIGHTED SCORES-----					
	---GOV'T EST---		----REALISM----		-----TOTAL-----	
	A	B	A	B	A	B
A	20.0	15.0	10.0	14.9	30.0	29.9
B	14.4	10.8	4.5	6.8	18.9	17.6
C	18.1	13.6	8.0	12.0	26.1	25.6
D	4.1	3.0	7.2	10.7	11.2	13.8
E	2.0	1.5	1.0	1.5	3.0	3.0

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY
 ----- (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
 (TO RETURN TO THE WORKSHEET, PRESS "Q")

	SCORES	WEIGHTED SCORES
SPREAD	G	H
WEIGHT		I

PRINT TABLE: FOLLOW LOTUS INSTRUCTIONS

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "S", AND
 TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
 FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
 (I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
 NAME FOR EACH GRAPH--FOR EXAMPLE, G1, H1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

Figure 7.

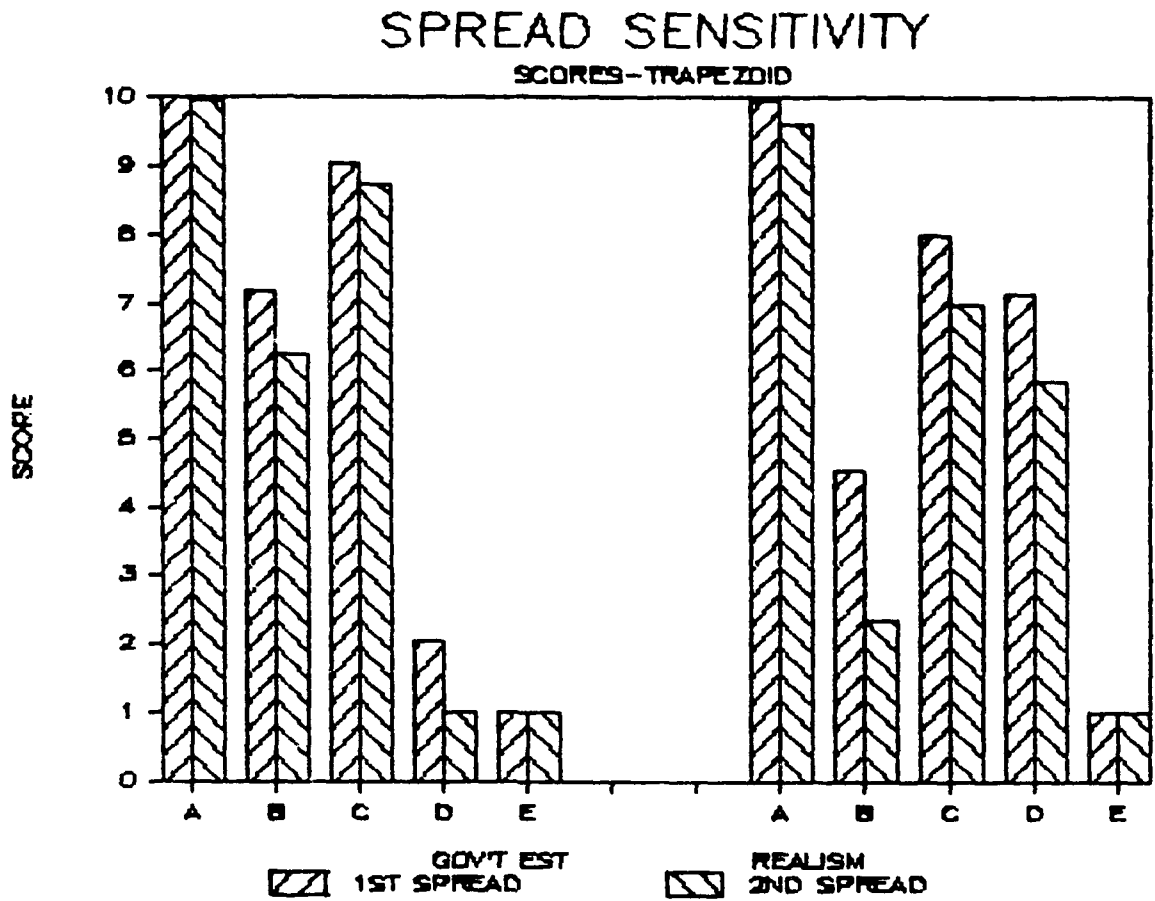


Figure 8.

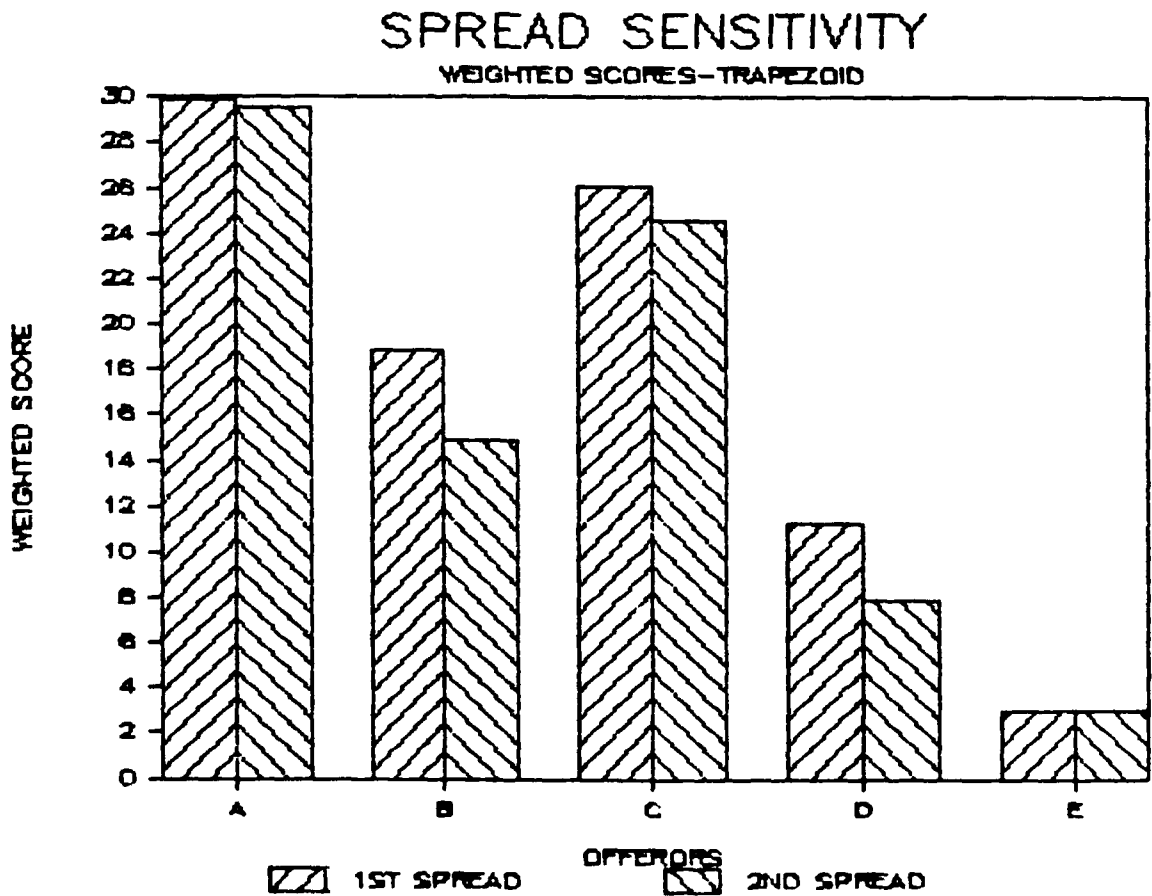


Figure 9.

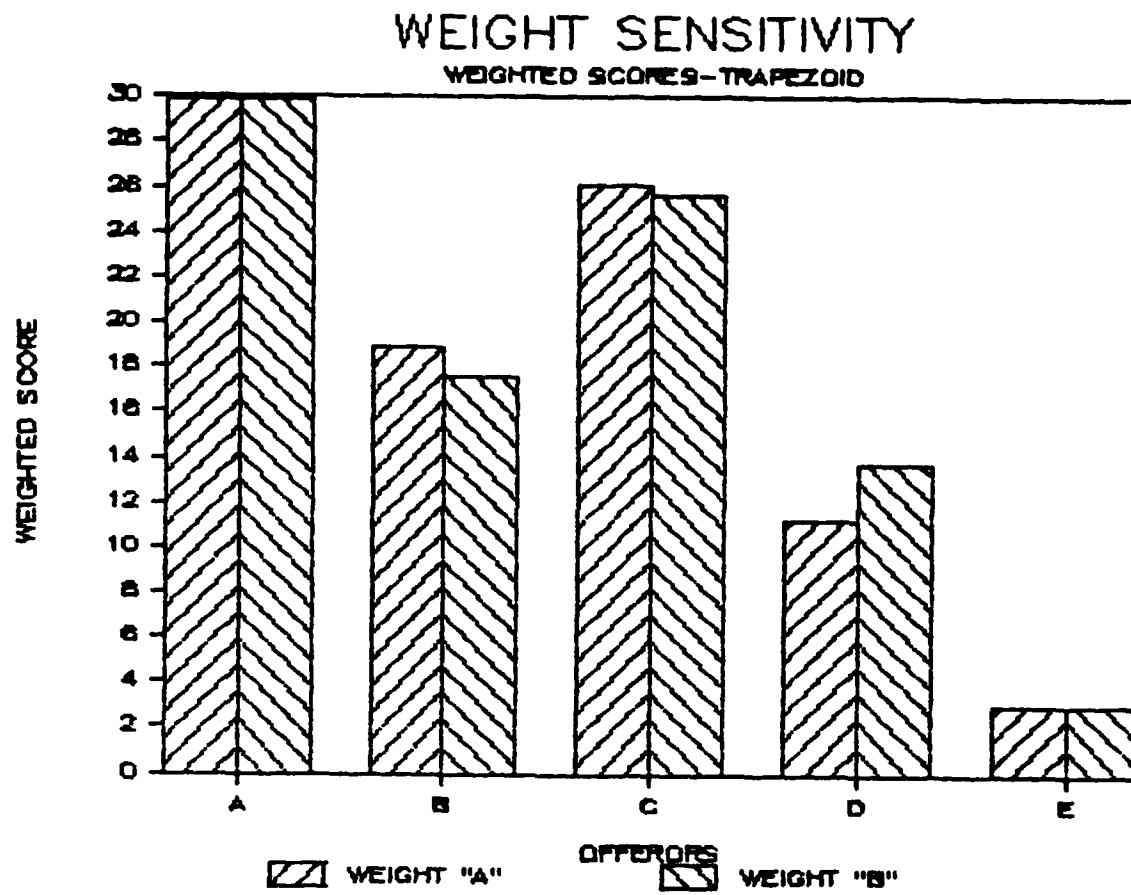


Table 3.

COST EVALUATION SCORING COMPARISON--TRAPEZOID SHAPE

[SCCOMPT]

ENTER: SPREADS AS DECIMALS

----- WEIGHTS AS WHOLE NUMBERS -OR- ENTER WEIGHT RATIOS AS DECIMALS

SPREAD:	CASE 1	CASE 2	CASE 3	
BASE-GOV'T EST	30.0%	40.0%	50.0%]
BASE-COST REALISM	15.0%	20.0%	25.0%]
TOP-GOV'T EST	0.0%	0.0%	0.0%]
TOP-COST REALISM	1.5%	2.0%	2.5%]
MIN SCORE-GV'T EST	1	1	1]
MIN SCORE-REALISM	1	1	1]

WEIGHT:					
TECHNICAL (T)	60.0	60.0	60.0]	AFTER ENTERING OR
GOV'T EST COST (E)	20.0	20.0	20.0]	CHANGING DATA,
COST REALISM (R)	10.0	10.0	10.0]	PRESS "F9" TO
OTHER	10.0	10.0	10.0]	RECALCULATE
TOTAL	100.0	100.0	100.0]	-----

WEIGHT RATIO:					
E/T	33.3%	33.3%	33.3%]	
R/T	16.7%	16.7%	16.7%]	
E/(E+R)	66.7%	66.7%	66.7%]	
R/(E+R)	33.3%	33.3%	33.3%]	

OFFEROR	OFFER (C)	GOV'T EST (G)	(G-G*)/G* (DELTA)	(C-G)/G (DELTA')
A	47.0	48.0	0.0%	-2.1%
B	47.0	54.0	12.5%	-13.0%
C	53.0	50.0	4.2%	6.0%
D	60.0	65.0	35.4%	-7.7%
E	89.0	70.0	45.8%	27.1%

CASE 1:	-----SCORES-----		-----WEIGHTED		SCORES-----	
OFFEROR	GOV'T EST	REALISM	GOV'T EST	REALISM	TOTAL	% OF MAX
A	10.0	9.6	20.0	9.6	29.6	99%
B	6.3	2.4	12.5	2.4	14.9	50%
C	8.8	7.0	17.5	7.0	24.5	82%
D	1.0	5.9	2.0	5.9	7.9	26%
E	1.0	1.0	2.0	1.0	3.0	10%

CASE 2:	-----SCORES-----		-----WEIGHTED		SCORES-----	
OFFEROR	GOV'T EST	REALISM	GOV'T EST	REALISM	TOTAL	% OF MAX
A	10.0	10.0	20.0	10.0	30.0	100%
B	7.2	4.5	14.4	4.5	18.9	63%
C	9.1	8.0	18.1	8.0	26.1	87%
D	2.0	7.2	4.1	7.2	11.2	37%
E	1.0	1.0	2.0	1.0	3.0	10%

CASE 3:	-----SCORES-----		-----WEIGHTED		SCORES-----	
OFFEROR	GOV'T EST	REALISM	GOV'T EST	REALISM	TOTAL	% OF MAX
A	10.0	10.0	20.0	10.0	30.0	100%
B	7.8	5.8	15.5	5.8	21.3	71%
C	9.3	8.6	18.5	8.6	27.1	90%
D	3.6	7.9	7.3	7.9	15.2	51%
E	1.8	1.0	3.5	1.0	4.5	15%

Table 3 (con't)

QUICK ENTRIES:

TO LOAD COMPLETE EXAMPLE, PRESS "ALT" KEY AND "X" SIMULTANEOUSLY
TO RETURN TO BLANK ENTRY FORM, PRESS "ALT" KEY AND "Y" SIMULTANEOUSLY

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY
----- (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
(TO RETURN TO THE WORKSHEET, PRESS "Q")

SCORE COMPARISON	A
WEIGHTED SCORE COMPARISON	B

PRINT TABLE: PRESS "ALT" KEY AND "P" SIMULTANEOUSLY

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "S", AND
TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
(I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
NAME FOR EACH GRAPH--FOR EXAMPLE, A1, B1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

Figure 10.

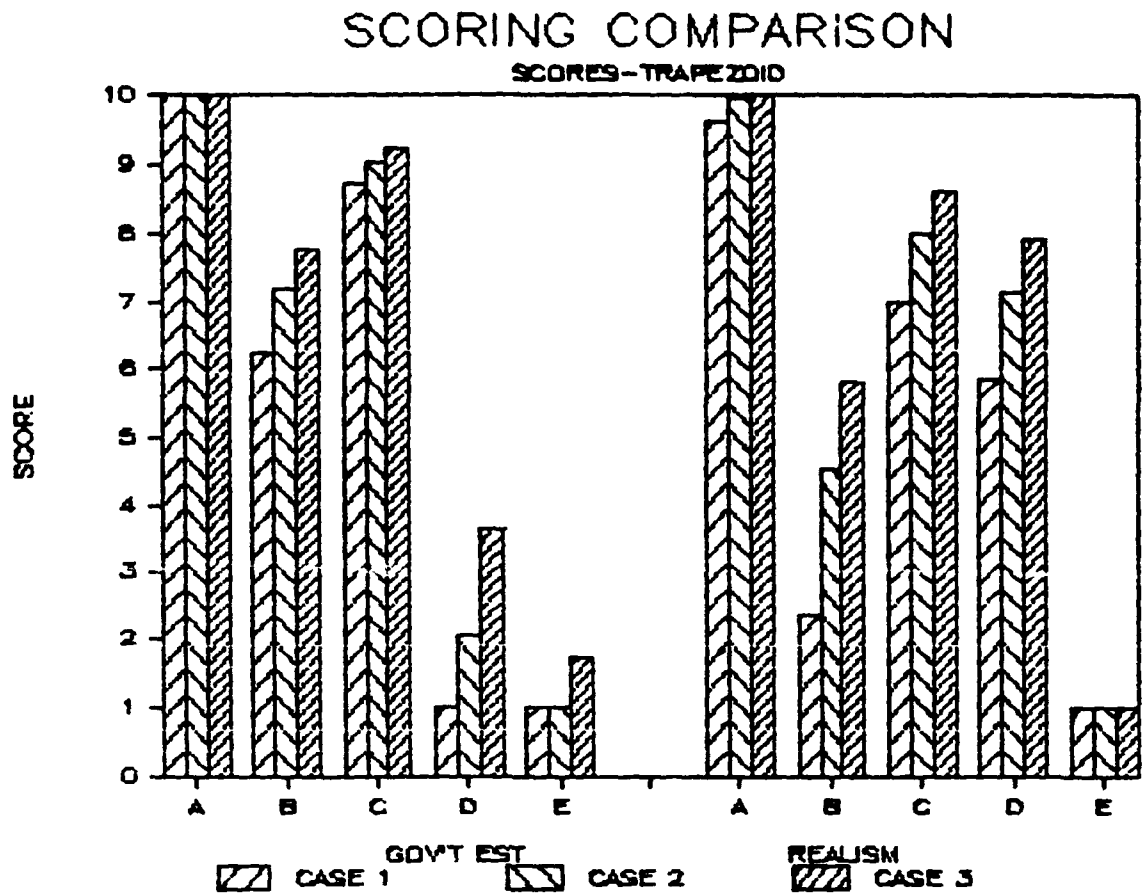


Figure 11.

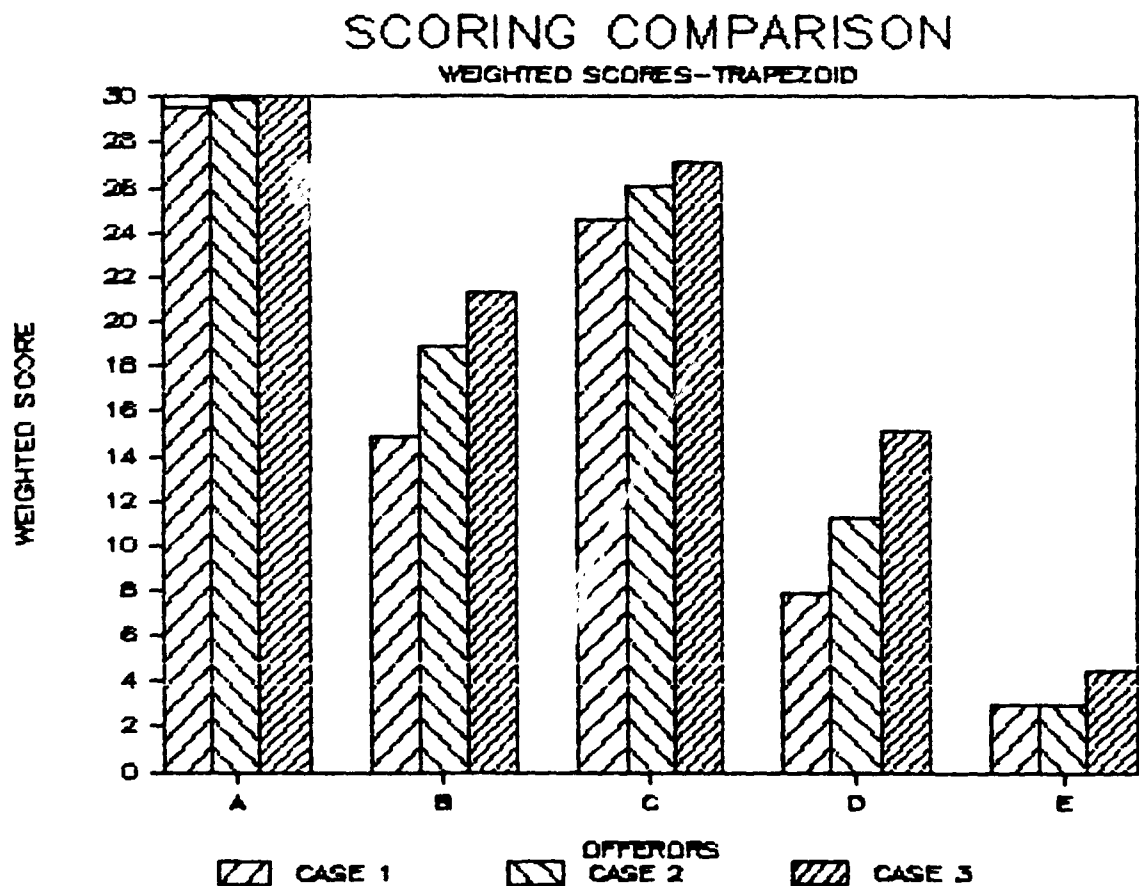


Table 4.

COST EVALUATION SCORING COMPARISON--TRAPEZOID SHAPE

[6CCOMPT]

ENTER: SPREADS AS DECIMALS

----- WEIGHTS AS WHOLE NUMBERS -OR- ENTER WEIGHT RATIOS AS DECIMALS

SPREAD:

READ:	CASE 1	CASE 2	CASE 3
BASE-GOV'T EST	40.0%	40.0%	40.0%
BASE-COST REALISM	20.0%	20.0%	20.0%
TOP-GOV'T EST	0.0%	0.0%	0.0%
TOP-COST REALISM	2.0%	2.0%	2.0%
MIN SCORE-GV'T EST	1	1	1
MIN SCORE-REALISM	1	1	1

WEIGHT:

TECHNICAL (T)	60.0	60.0	60.0
GOV'T EST COST (E)	15.0	20.0	22.5
COST REALISM (R)	15.0	10.0	7.5
OTHER	10.0	10.0	10.0
TOTAL	100.0	100.0	100.0

AFTER ENTERING OR
CHANGING DATA,
PRESS "F9" TO
RECALCULATE

WEIGHT RATIO:

E/T	25.0%	33.3%	37.5%
R/T	25.0%	16.7%	12.5%
E/(E+R)	50.0%	66.7%	75.0%
R/(E+R)	50.0%	33.3%	25.0%

or

OFFEROR	OFFER (C)	GOV'T EST (G)	(G-G*)/G* (DELTA)	(C-G)/G (DELTA')
A	47.0	48.0	0.0%	-2.1%
B	47.0	54.0	12.5%	-13.0%
C	53.0	50.0	4.2%	6.0%
D	60.0	65.0	35.4%	-7.7%
E	89.0	70.0	45.8%	27.1%

CASE 1: OFFEROR	-----SCORES-----		-----WEIGHTED SCORES-----		TOTAL	% OF MAX
	GOV'T EST	REALISM	GOV'T EST	REALISM		
A	10.0	10.0	15.0	14.9	29.9	100%
B	7.2	4.5	10.8	6.8	17.6	59%
C	9.1	8.0	13.6	12.0	25.6	85%
D	2.0	7.2	3.0	10.7	13.8	46%
E	1.0	1.0	1.5	1.5	3.0	10%

CASE 2: OFFEROR	-----SCORES-----		-----WEIGHTED SCORES-----		TOTAL	% OF MAX
	GOV'T EST	REALISM	GOV'T EST	REALISM		
A	10.0	10.0	20.0	10.0	30.0	100%
B	7.2	4.5	14.4	4.5	18.9	63%
C	9.1	8.0	18.1	8.0	26.1	87%
D	2.0	7.2	4.1	7.2	11.2	37%
E	1.0	1.0	2.0	1.0	3.0	10%

CASE 3: OFFEROR	-----SCORES-----		-----WEIGHTED SCORES-----			
	GOV'T EST	REALISM	GOV'T EST	REALISM	TOTAL	% OF MAX
A	10.0	10.0	22.5	7.5	30.0	100%
B	7.2	4.5	16.2	3.4	19.6	65%
C	9.1	8.0	20.4	6.0	26.4	88%
D	2.0	7.2	4.6	5.4	9.9	33%
E	1.0	1.0	2.3	0.8	3.0	10%

Table 4 (con't)

QUICK ENTRIES:

TO LOAD COMPLETE EXAMPLE, PRESS "ALT" KEY AND "X" SIMULTANEOUSLY
TO RETURN TO BLANK ENTRY FORM, PRESS "ALT" KEY AND "Y" SIMULTANEOUSLY

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY
----- (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
(TO RETURN TO THE WORKSHEET, PRESS "Q")

SCORE COMPARISON	A
WEIGHTED SCORE COMPARISON	B

PRINT TABLE: PRESS "ALT" KEY AND "P" SIMULTANEOUSLY

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "S", AND
TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
(I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
NAME FOR EACH GRAPH--FOR EXAMPLE, A1, B1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

Figure 12.

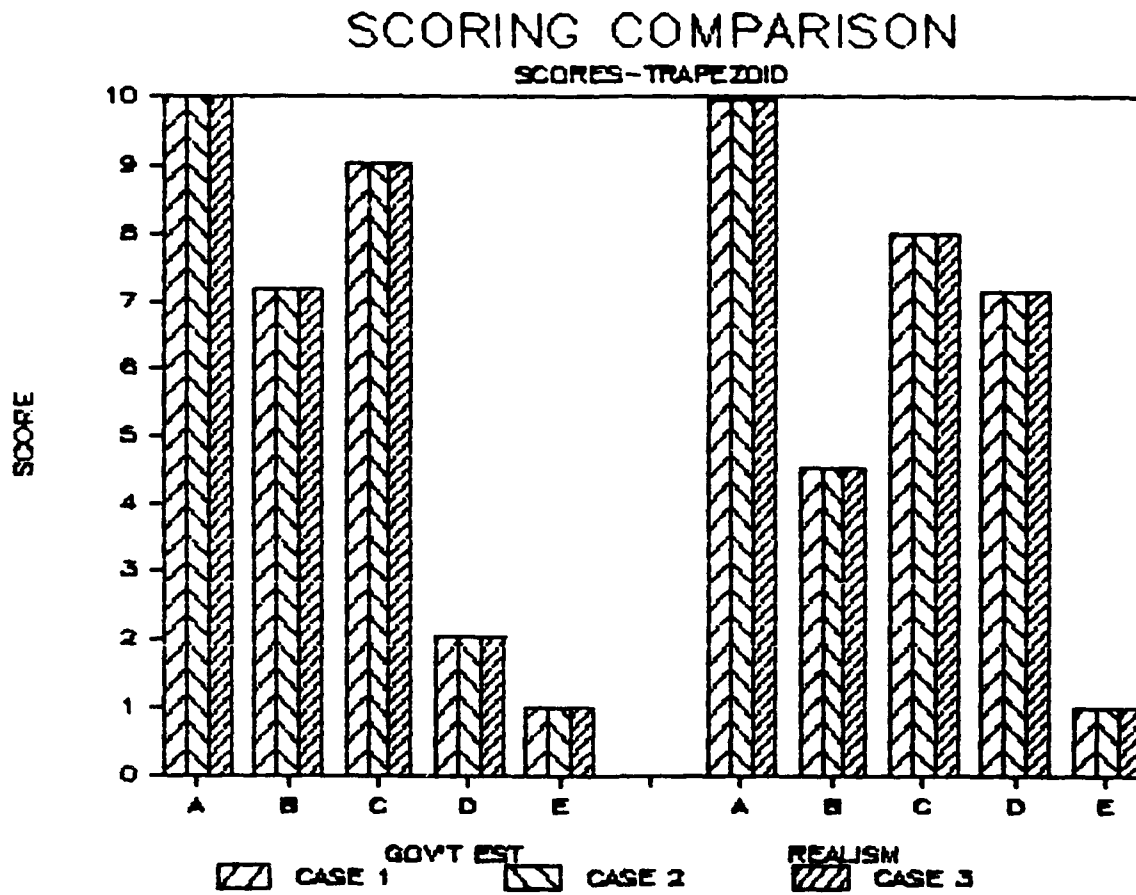


Figure 13.

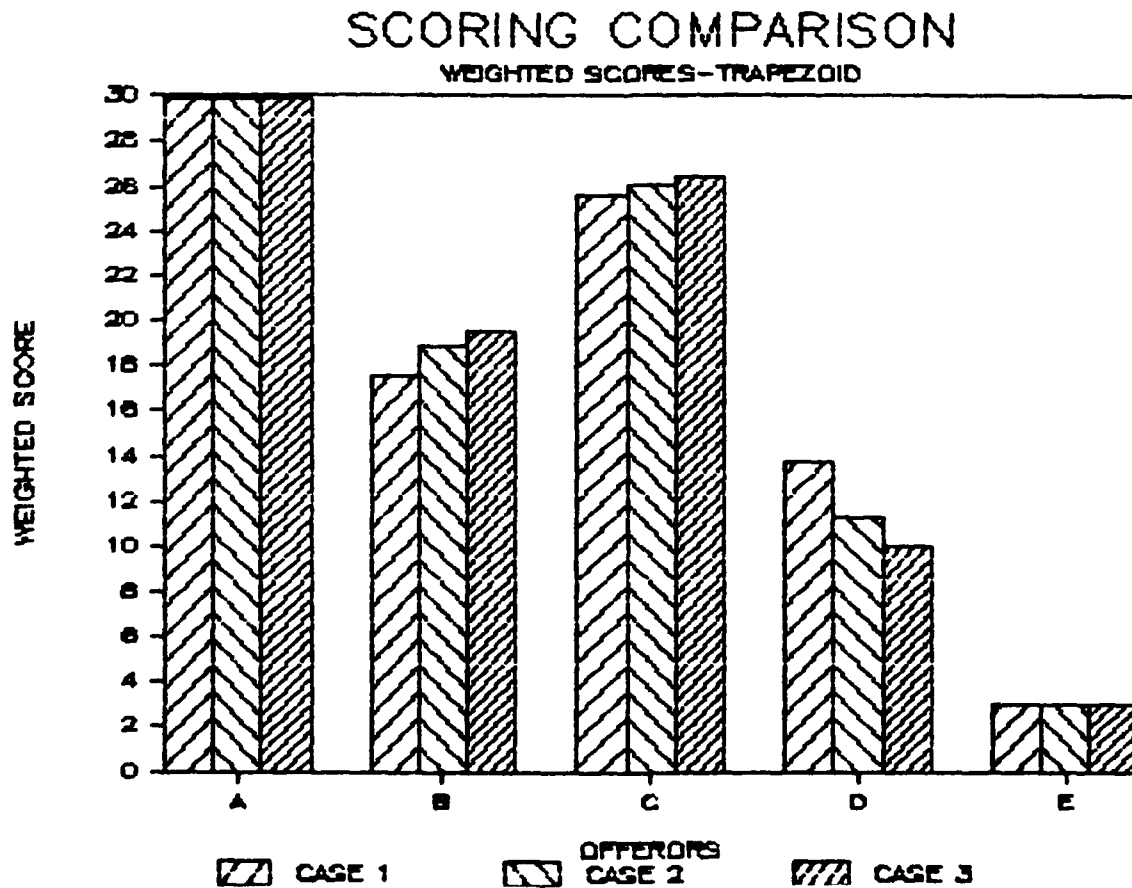


Table 5.

COST EVALUATION TRADEOFF MODEL--TRAPEZOID SHAPE

[TRDTRAP]

ENTER: SPREADS AND ENVELOPES AS DECIMALS

----- WEIGHTS AS WHOLE NUMBERS -OR- ENTER WEIGHT RATIOS AS DECIMALS
 APPROXIMATE COST IN MILLIONS OF DOLLARS

SPREAD:	-----BASE-----			-----TOP-----			MIN SCORE	
	1ST	2ND	3RD	1ST	2ND	3RD		
GOV'T EST	30.0%	40.0%	50.0%	0.0%	0.0%	0.0%	1]
REALISM	15.0%	20.0%	25.0%	1.5%	2.0%	2.5%	1]

WEIGHT:	A			
	60.0	60.0	60.0	
TECHNICAL (T)	60.0	60.0	60.0]
GOV'T EST (E)	15.0	20.0	22.5]
COST REALISM (R)	15.0	10.0	7.5]
OTHER	10.0	10.0	10.0]
TOTAL	100.0	100.0	100.0	!

or

WEIGHT RATIO:	A			
	25.0%	33.3%	37.5%	
E/T	25.0%	33.3%	37.5%]
R/T	25.0%	16.7%	12.5%]
E/(E+R)	50.0%	66.7%	75.0%	
R/(E+R)	50.0%	33.3%	25.0%	

APPROXIMATE COST: MILLION (OPTIONAL)]

ENVELOPES: TECHNICAL COST WILLING UNREALISM WILLING
 ADVANTAGE TO ACCEPT TO ACCEPT
 MIN MAX MIN MAX

5.0%	3.8%	8.8%	5.0%	12.5%]
10.0%	7.5%	17.5%	7.5%	17.5%]
20.0%	15.0%	35.0%	12.5%	25.0%]

or

5.0%	\$1.9	\$4.4	\$2.5	\$6.3]
10.0%	\$3.8	\$8.8	\$3.8	\$8.8]
20.0%	\$7.5	\$17.5	\$6.3	\$12.5]

AFTER ENTERING OR CHANGING DATA, PRESS "F9" TO RECALCULATE

QUICK ENTRIES:

TO LOAD ILLUSTRATIVE ENVELOPE, PRESS "ALT" KEY AND "V" SIMULTANEOUSLY
 TO LOAD COMPLETE EXAMPLE, PRESS "ALT" KEY AND "X" SIMULTANEOUSLY
 TO RETURN TO BLANK ENTRY FORM, PRESS "ALT" KEY AND "Y" SIMULTANEOUSLY

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY
 (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
 (TO RETURN TO THE WORKSHEET, PRESS "Q")

	1ST	2ND	3RD	SPREAD	BAND
	SPREAD	SPREAD	SPREAD	DIFFERENCE	
GOV'T EST COST	A	D	G	J	M
COST REALISM	B	E	H	K	N
GOV'T EST/REALISM	C	F	I	L	

NOTE: SPREAD DIFFERENCE FOR WT "B". BAND FOR 2ND SPREAD & WT "B"

Table 5 (con't)

PRINT TABLE: PRESS "ALT" KEY AND "P" SIMULTANEOUSLY

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "S", AND
TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
(I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
NAME FOR EACH GRAPH--FOR EXAMPLE, A1, B1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

Figure 14.

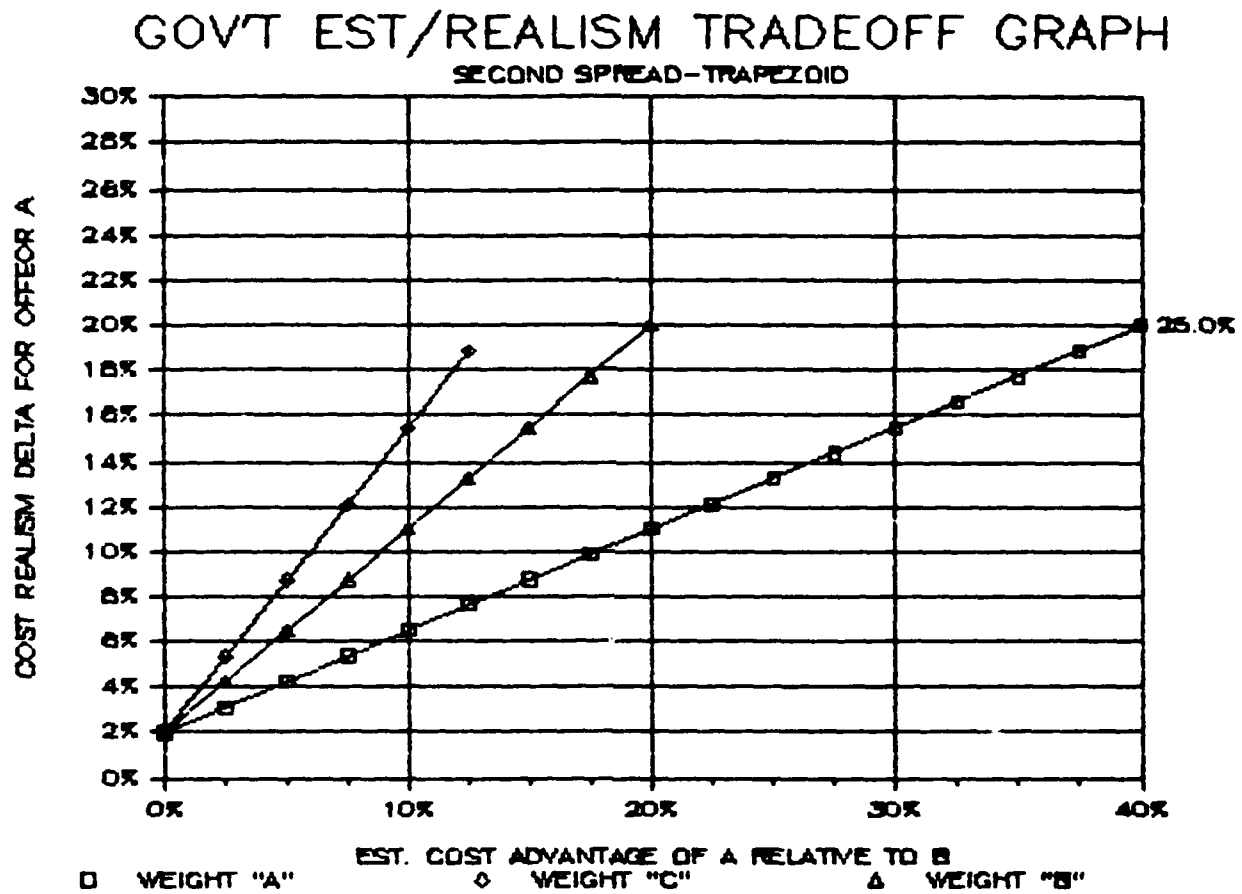


Figure 15.

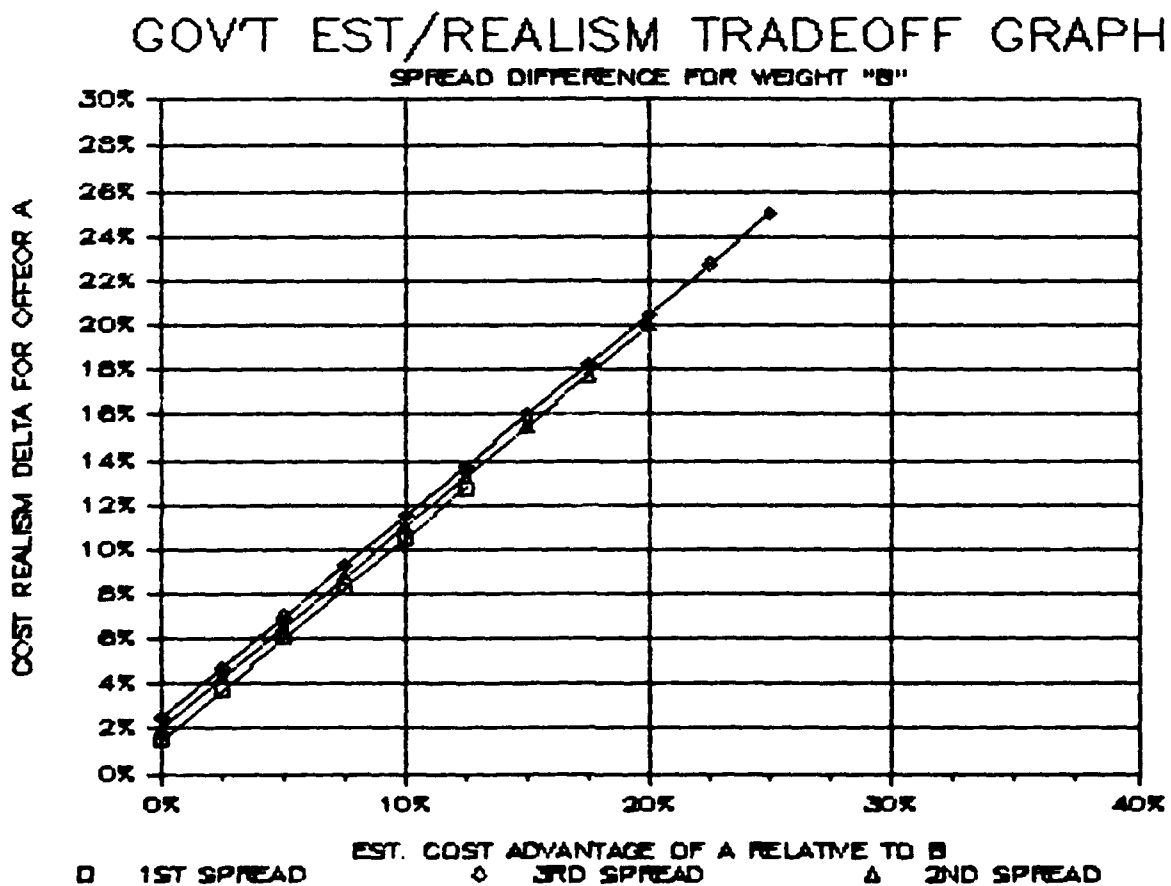


Figure 16

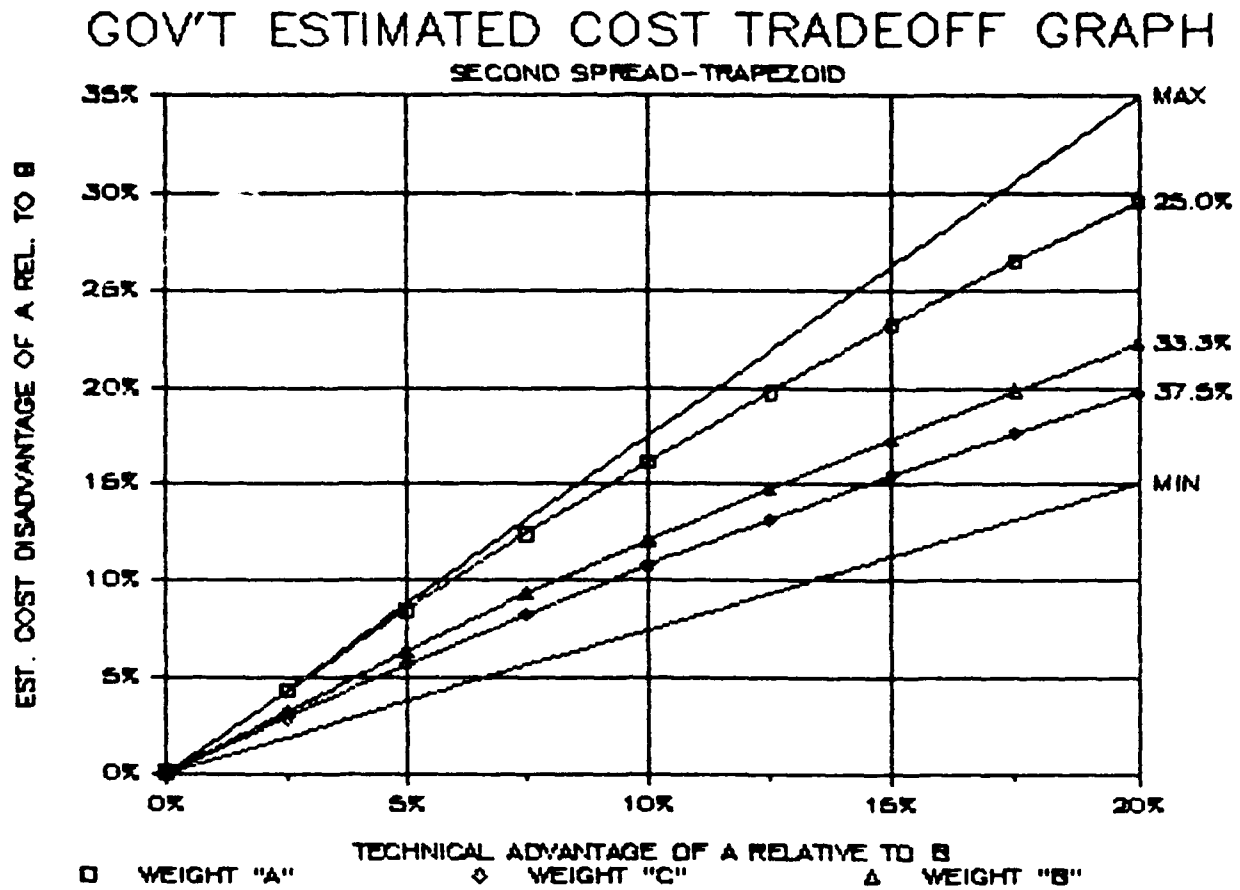


Figure 17.

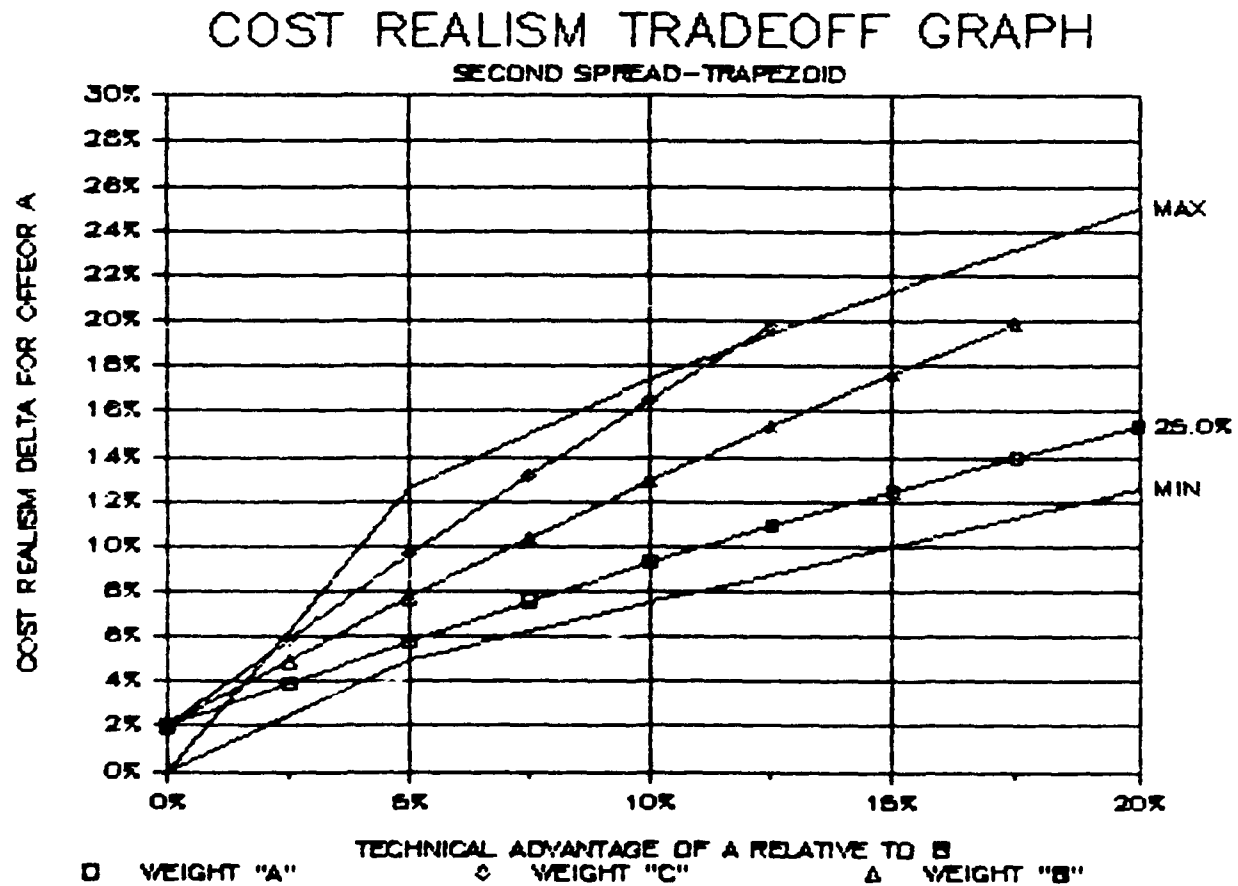


Figure 18.

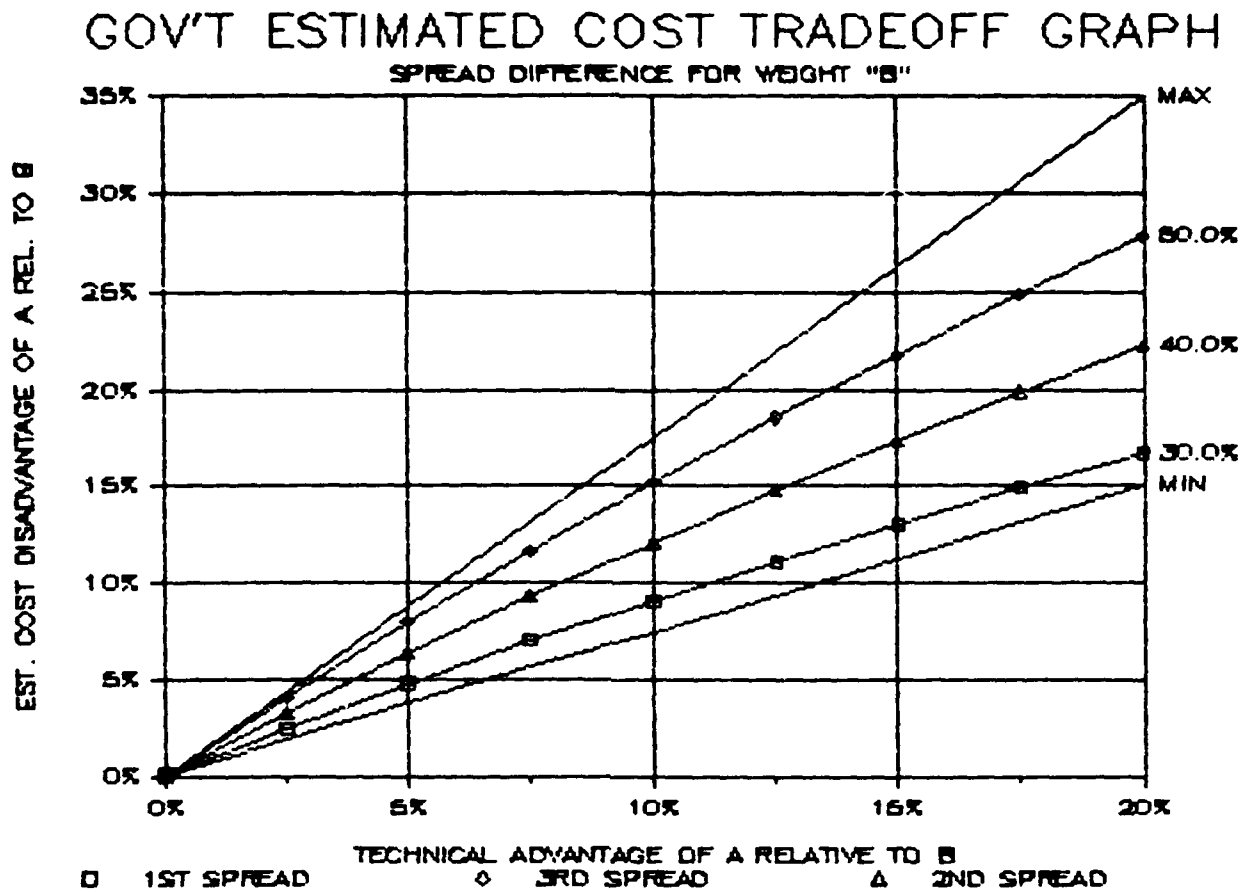


Figure 19.

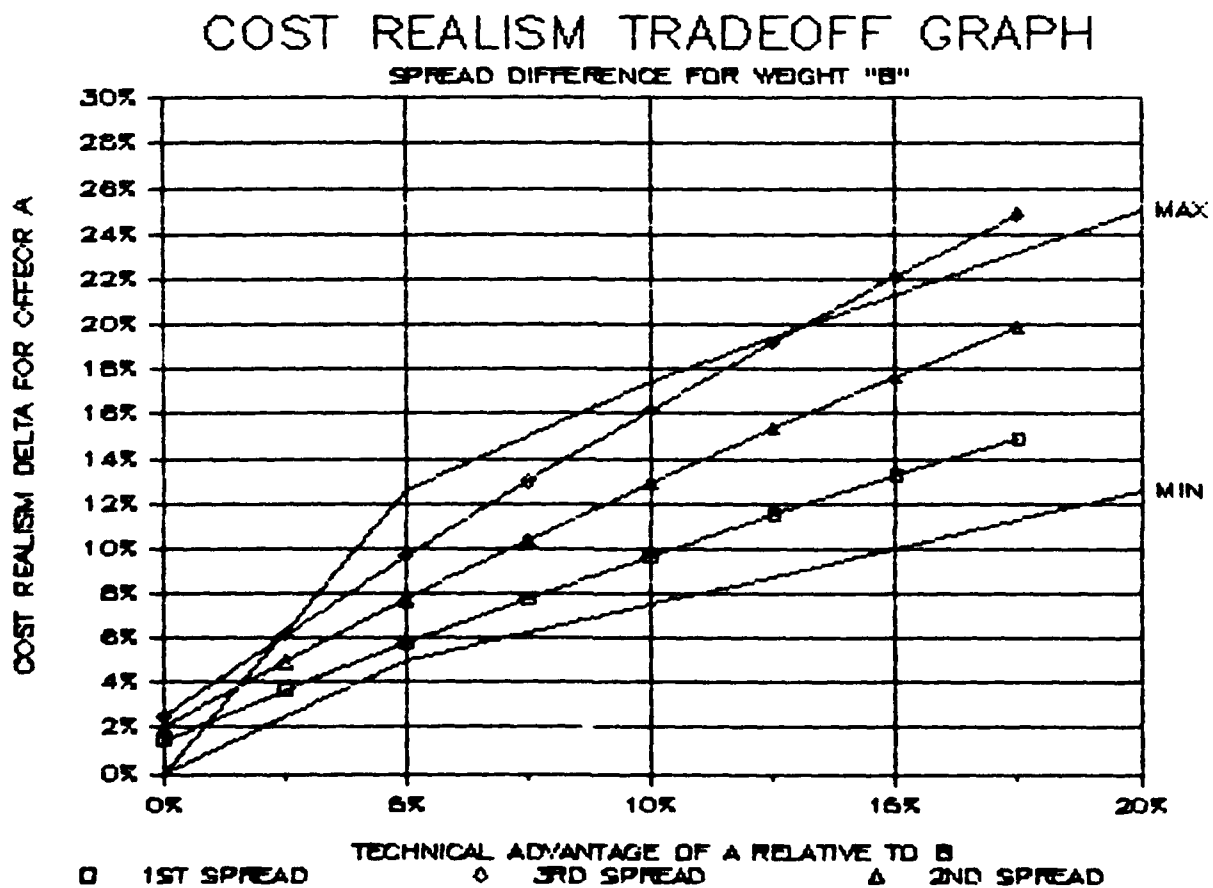


Figure 20.

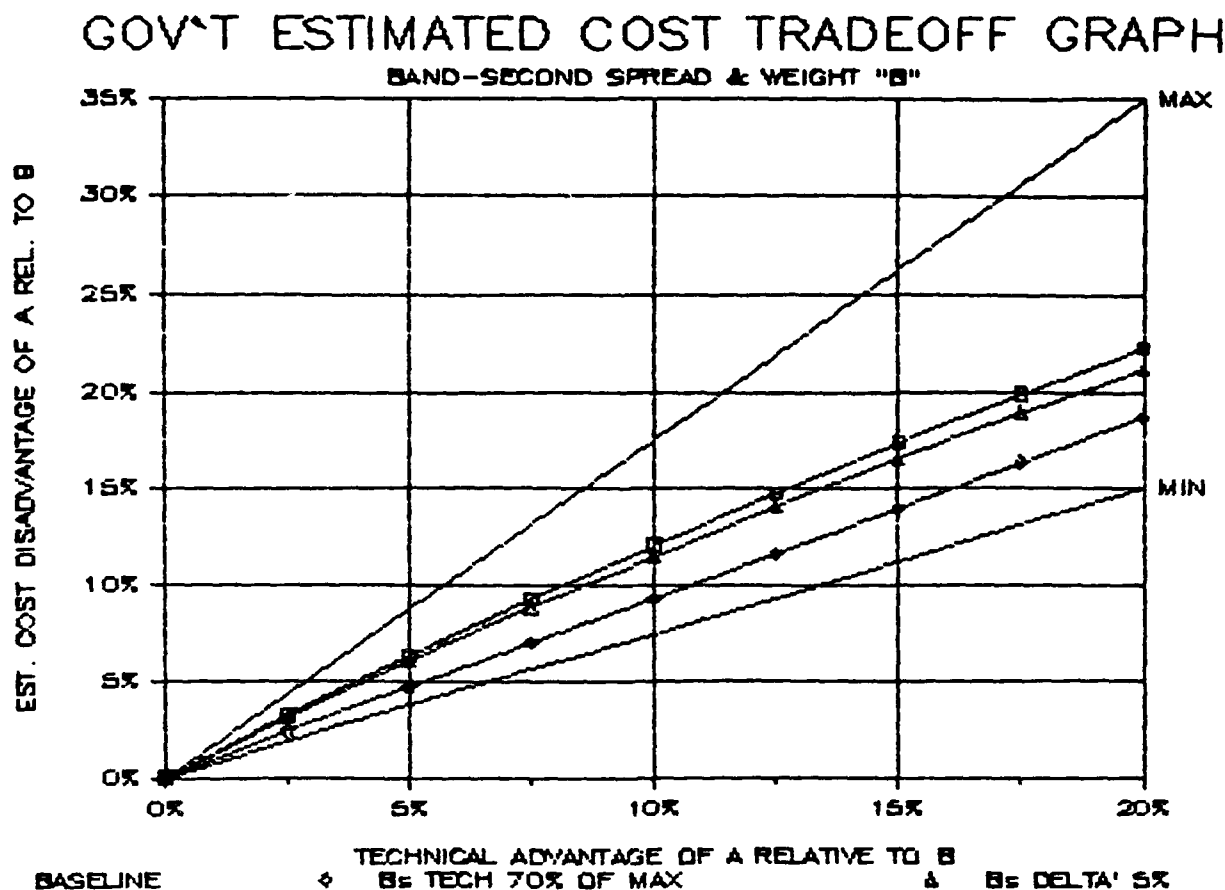


Figure 21.

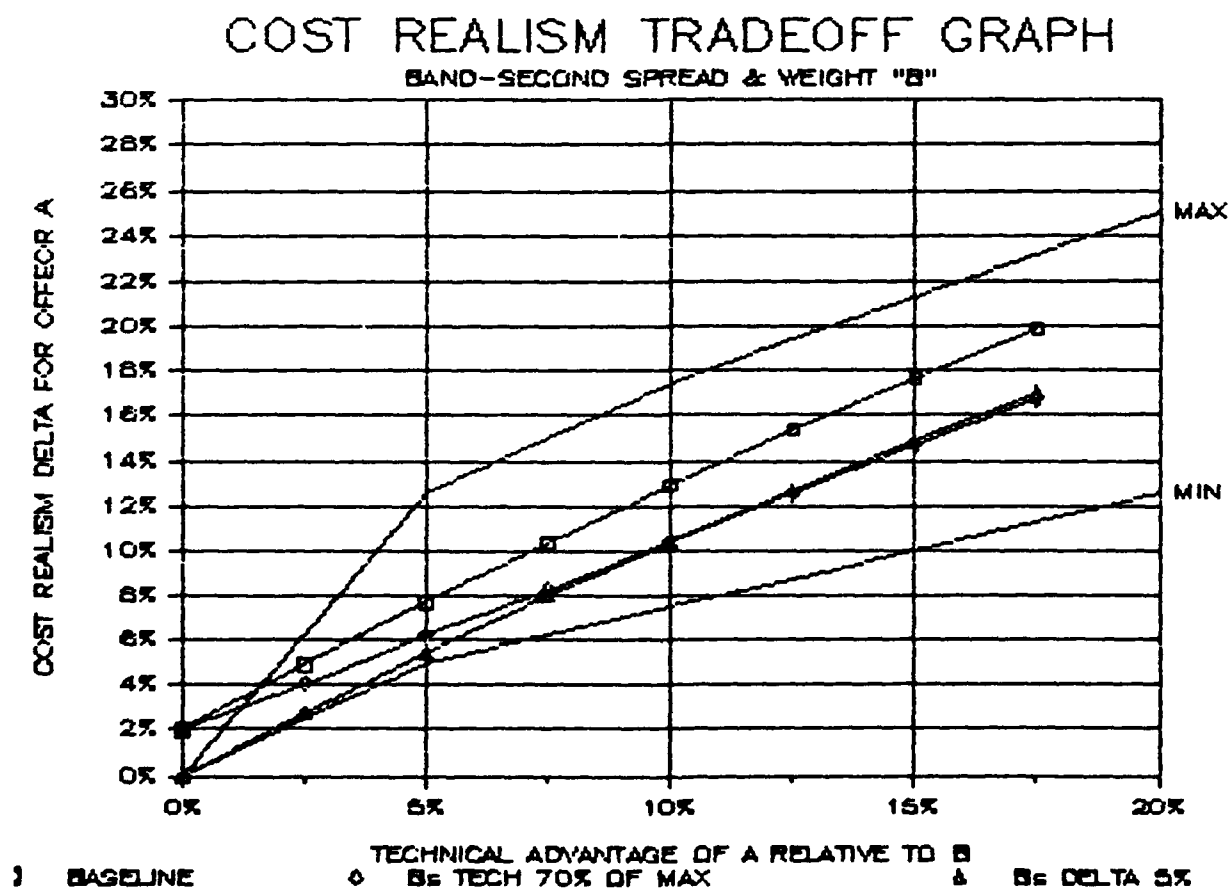


Figure 22.

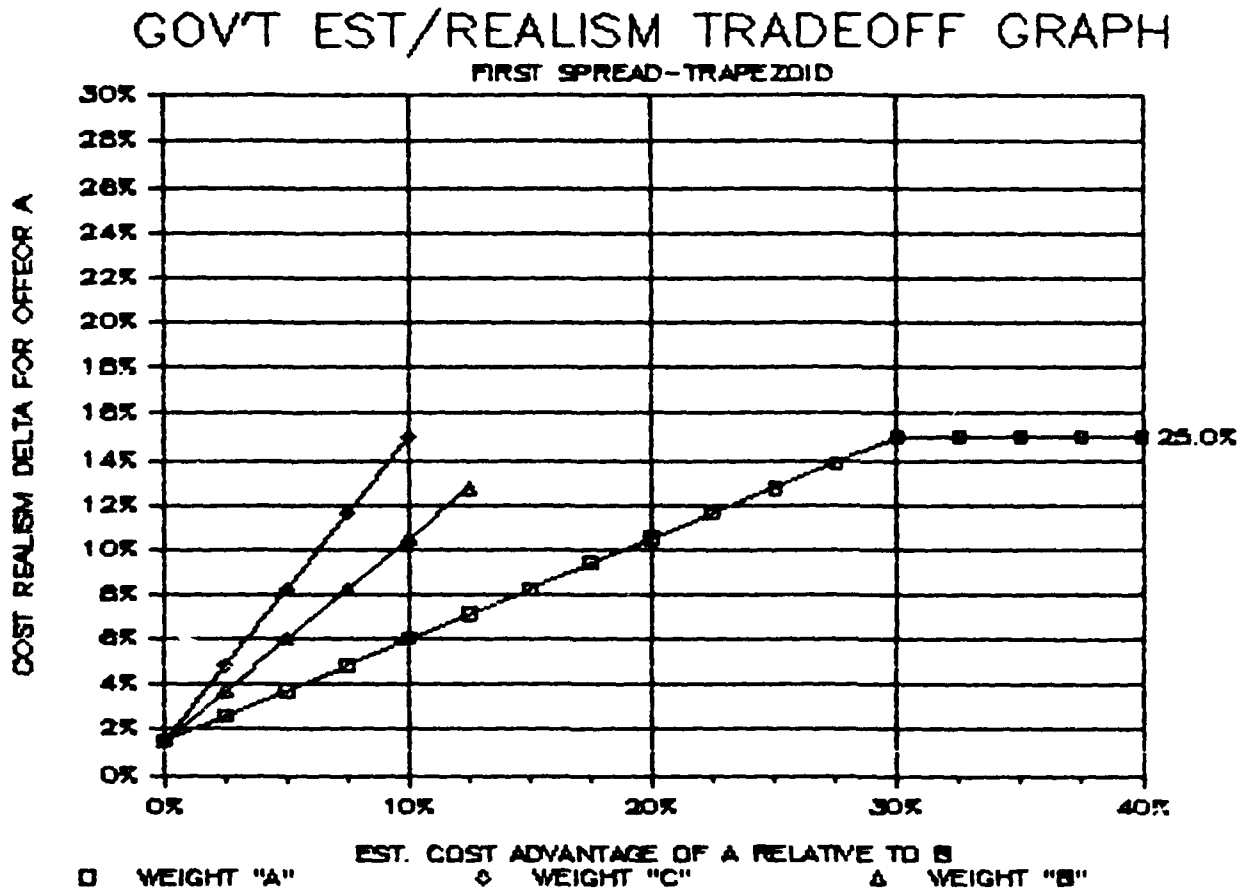


Figure 23.

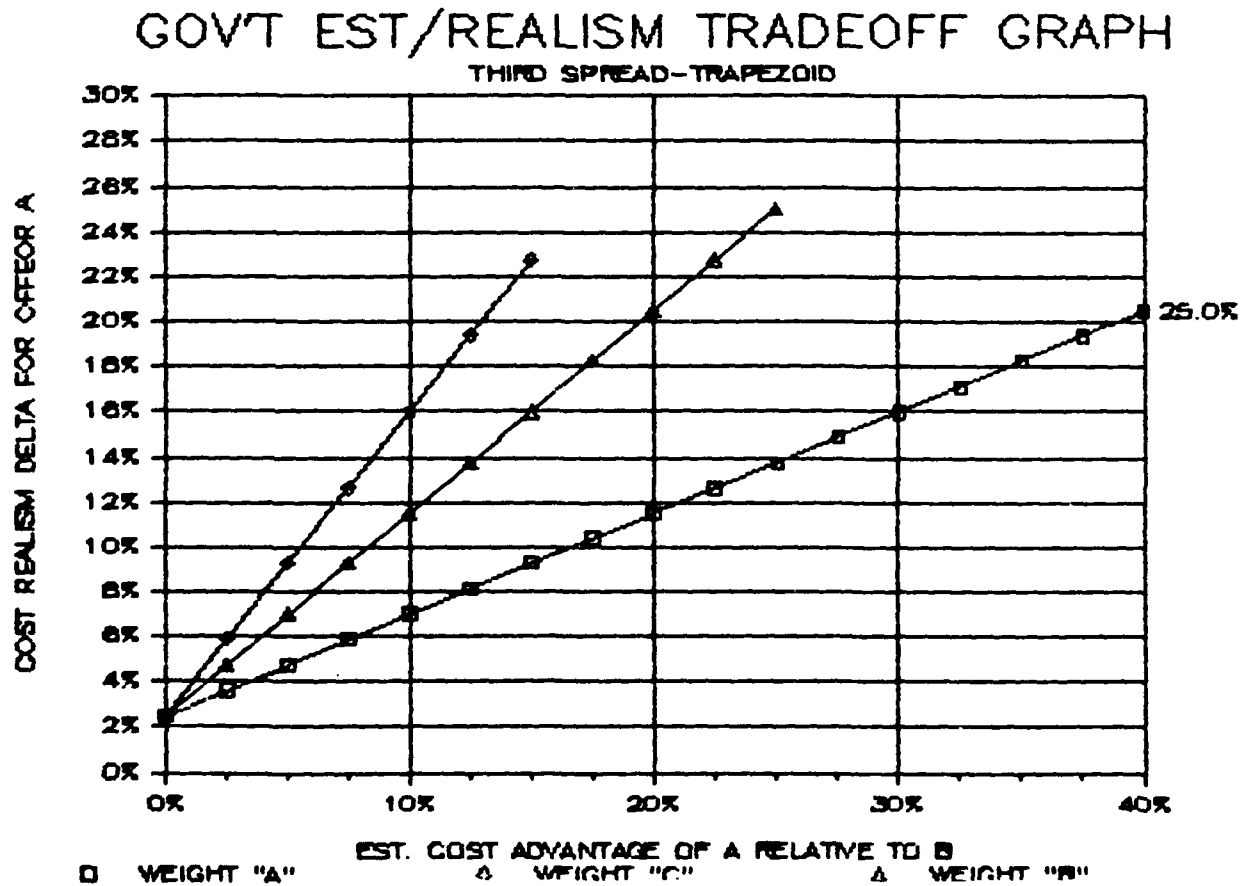


Figure 24.

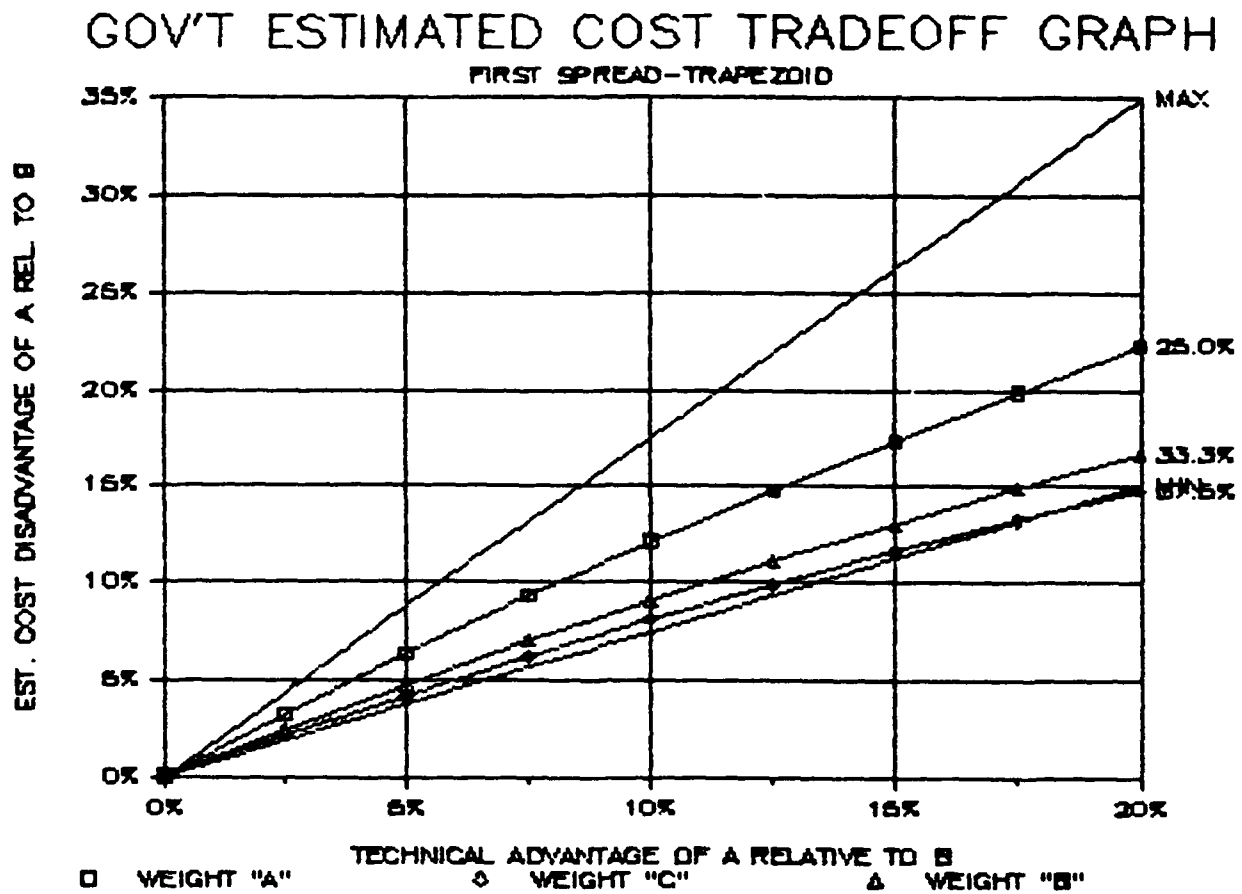


Figure 25.

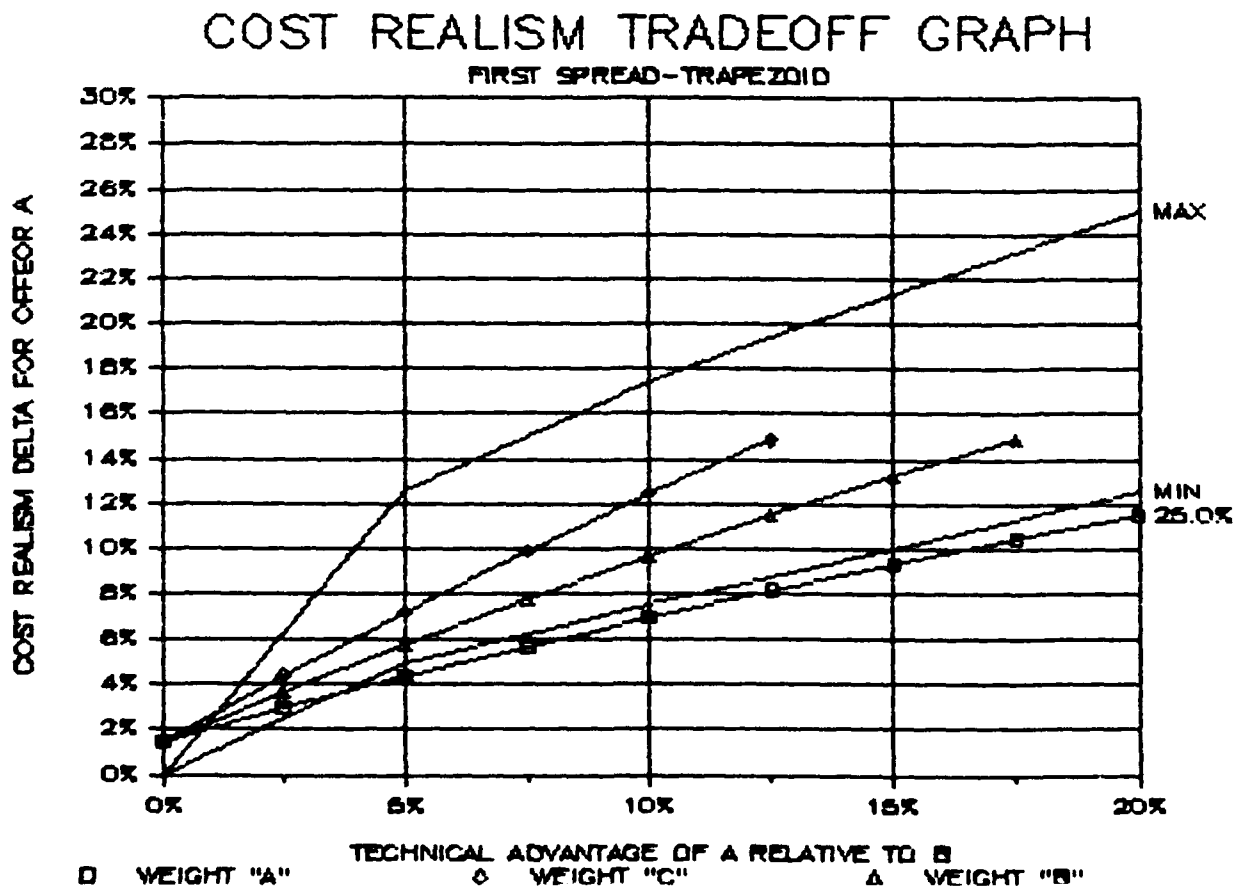


Figure 26.

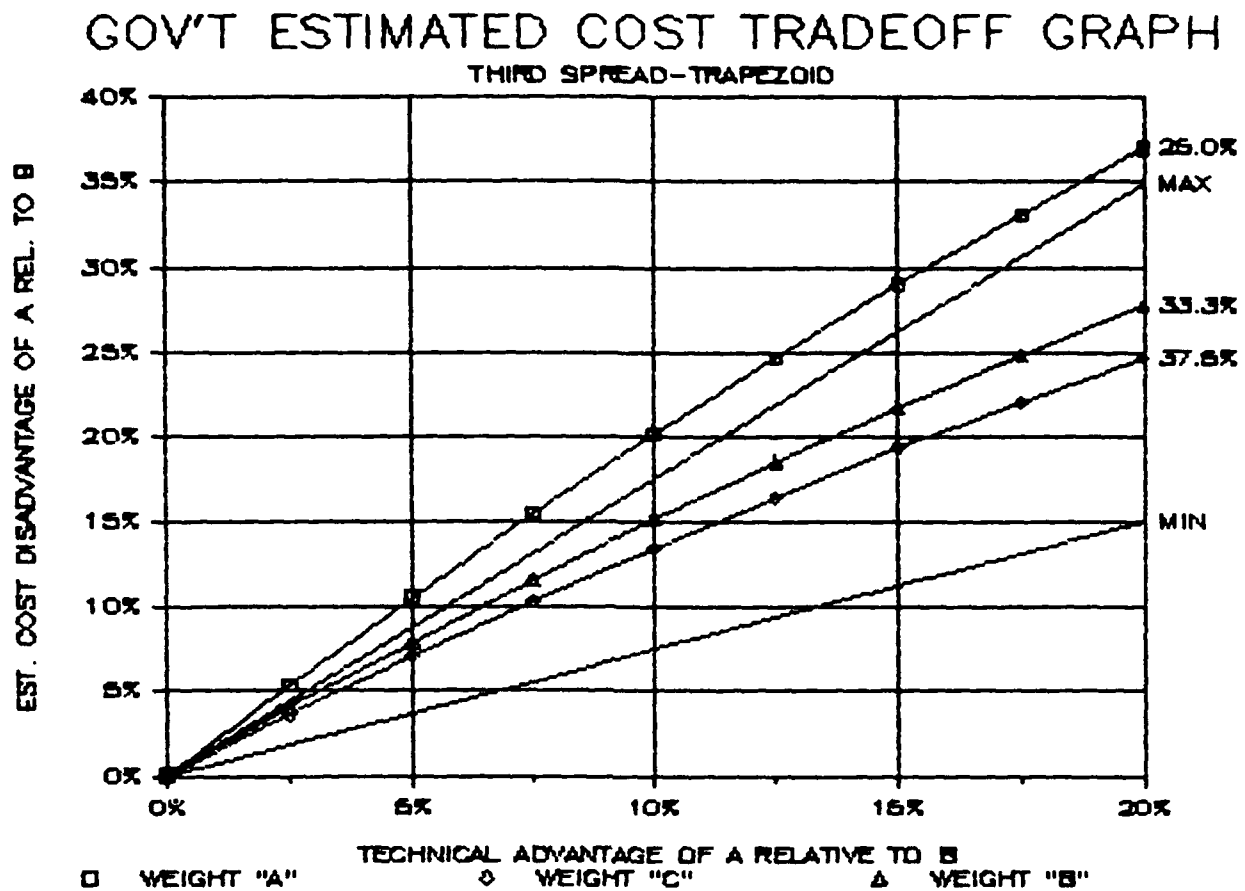


Figure 27.

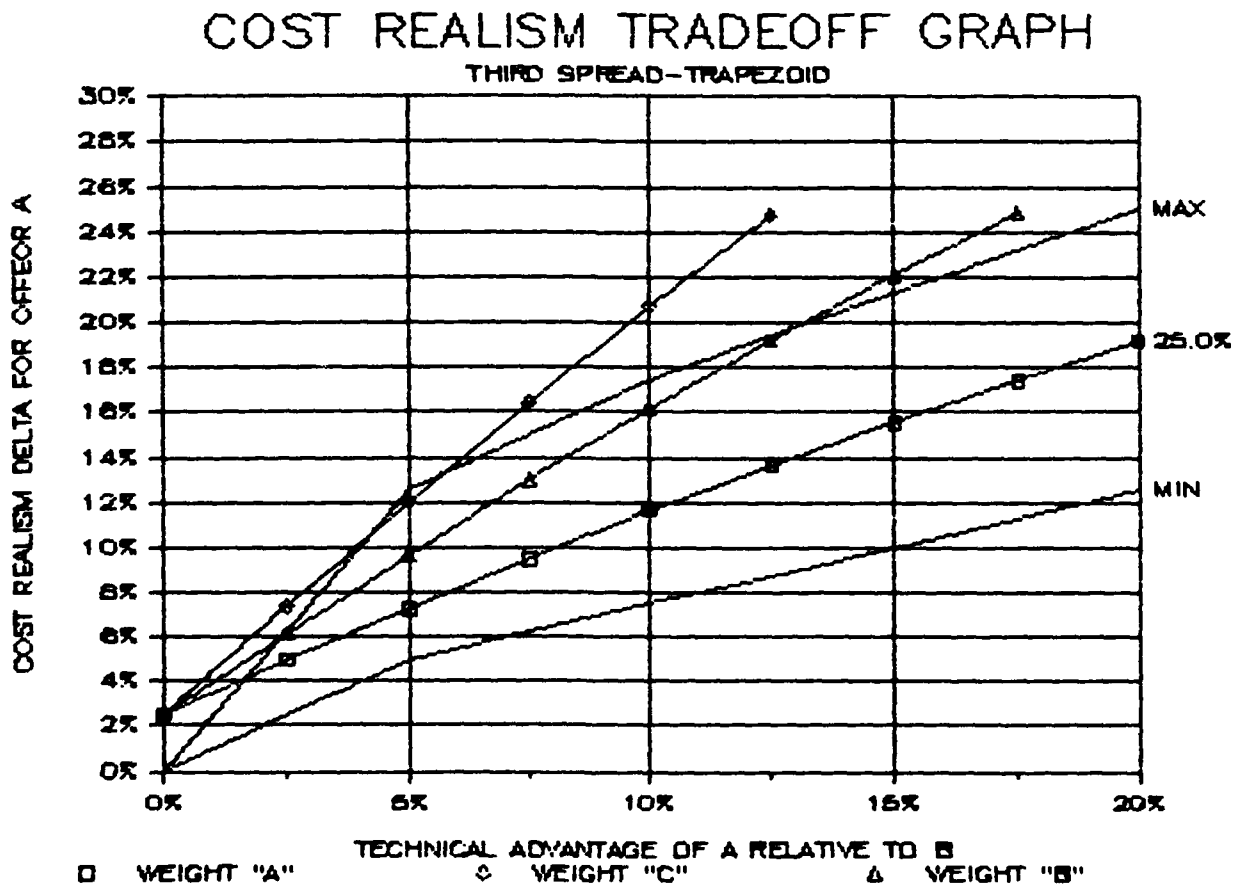


Table 6.

COST EVALUATION TRADEOFF MODEL--TRAPEZOID SHAPE

[TRDTRAP]

ENTER: SPREADS AND ENVELOPES AS DECIMALS

----- WEIGHTS AS WHOLE NUMBERS -OR- ENTER WEIGHT RATIOS AS DECIMALS
APPROXIMATE COST IN MILLIONS OF DOLLARS

SPREAD:	-----BASE-----			-----TOP-----			MIN SCORE	
	1ST	2ND	3RD	1ST	2ND	3RD		
GOV'T EST	30.0%	40.0%	50.0%	0.0%	0.0%	0.0%	1]
REALISM	15.0%	20.0%	25.0%	1.5%	2.0%	2.5%	1]

WEIGHT:	A	B	C	
TECHNICAL (T)	70.0	60.0	55.0]
GOV'T EST (E)	13.3	20.0	23.3]
COST REALISM (R)	6.7	10.0	11.7]
OTHER	10.0	10.0	10.0]
TOTAL	100.0	100.0	100.0]

or

WEIGHT RATIO:	A	B	C	
E/T	19.0%	33.3%	42.4%]
R/T	9.5%	16.7%	21.2%]
E/(E+R)	66.7%	66.7%	66.7%]
R/(E+R)	33.3%	33.3%	33.3%]

APPROXIMATE COST: MILLION (OPTIONAL)]

ENVELOPES: TECHNICAL ADVANTAGE COST WILLING TO ACCEPT UNREALISM WILLING TO ACCEPT

MIN MAX MIN MAX

5.0%	3.8%	8.8%	5.0%	12.5%]
10.0%	7.5%	17.5%	7.5%	17.5%]
20.0%	15.0%	35.0%	12.5%	25.0%]

or

5.0%	\$1.9	\$4.4	\$2.5	\$6.3]
10.0%	\$3.8	\$8.8	\$3.8	\$8.8]
20.0%	\$7.5	\$17.5	\$6.3	\$12.5]

AFTER ENTERING OR CHANGING DATA, PRESS "F9" TO RECALCULATE

QUICK ENTRIES:

TO LOAD ILLUSTRATIVE ENVELOPE, PRESS "ALT" KEY AND "V" SIMULTANEOUSLY
 TO LOAD COMPLETE EXAMPLE, PRESS "ALT" KEY AND "X" SIMULTANEOUSLY
 TO RETURN TO BLANK ENTRY FORM, PRESS "ALT" KEY AND "Y" SIMULTANEOUSLY

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY
 ----- (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
 (TO RETURN TO THE WORKSHEET, PRESS "Q")

	1ST SPREAD	2ND SPREAD	3RD SPREAD	SPREAD DIFFERENCE	BAND
GOV'T EST COST	A	D	G	J	M
COST REALISM	B	E	H	K	N
GOV'T EST/REALISM	C	F	I	L	

NOTE: SPREAD DIFFERENCE FOR WT "B". BAND FOR 2ND SPREAD & WT "B"

Table 6 (con't)

PRINT TABLE: PRESS "ALT" KEY AND "P" SIMULTANEOUSLY

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "S", AND
TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
(I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
NAME FOR EACH GRAPH--FOR EXAMPLE, A1, B1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

Figure 28.

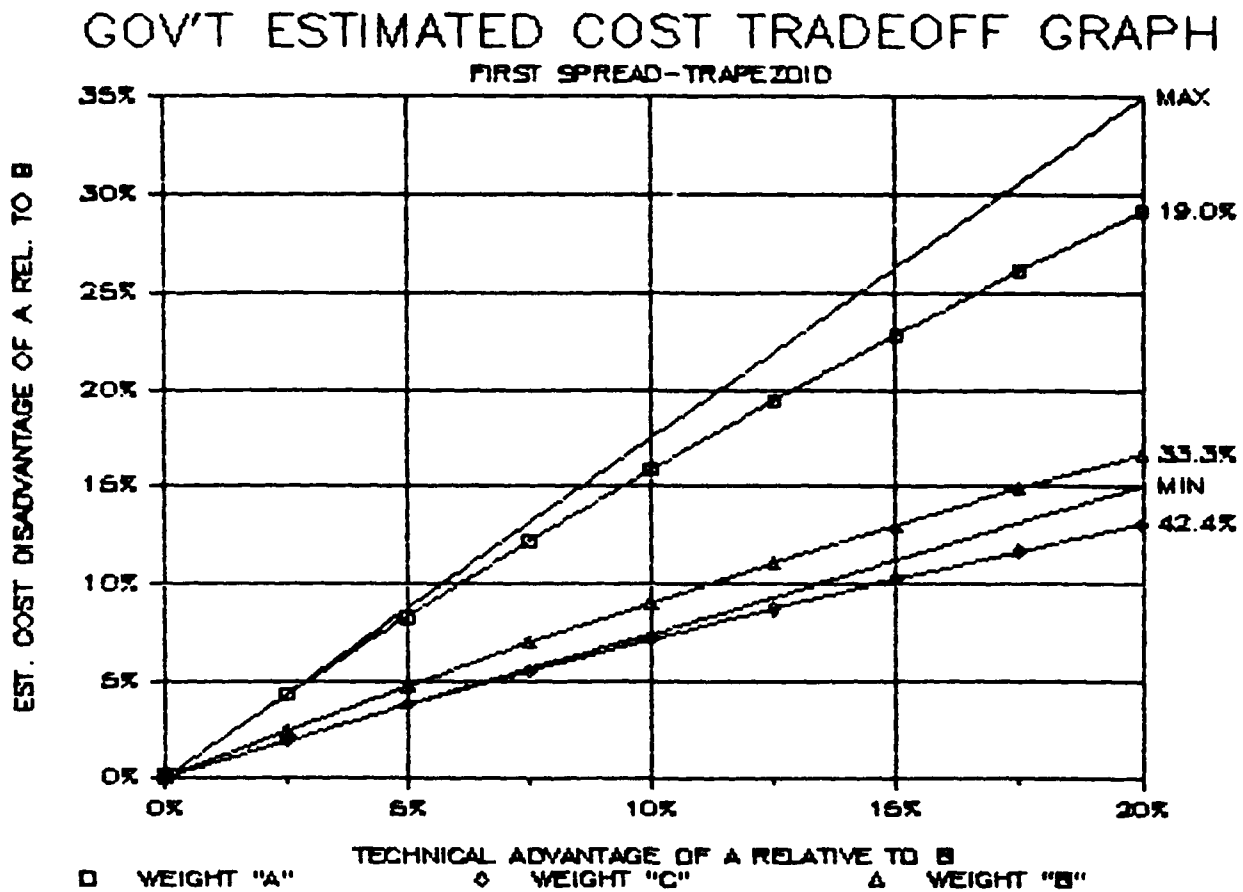


Figure 29.

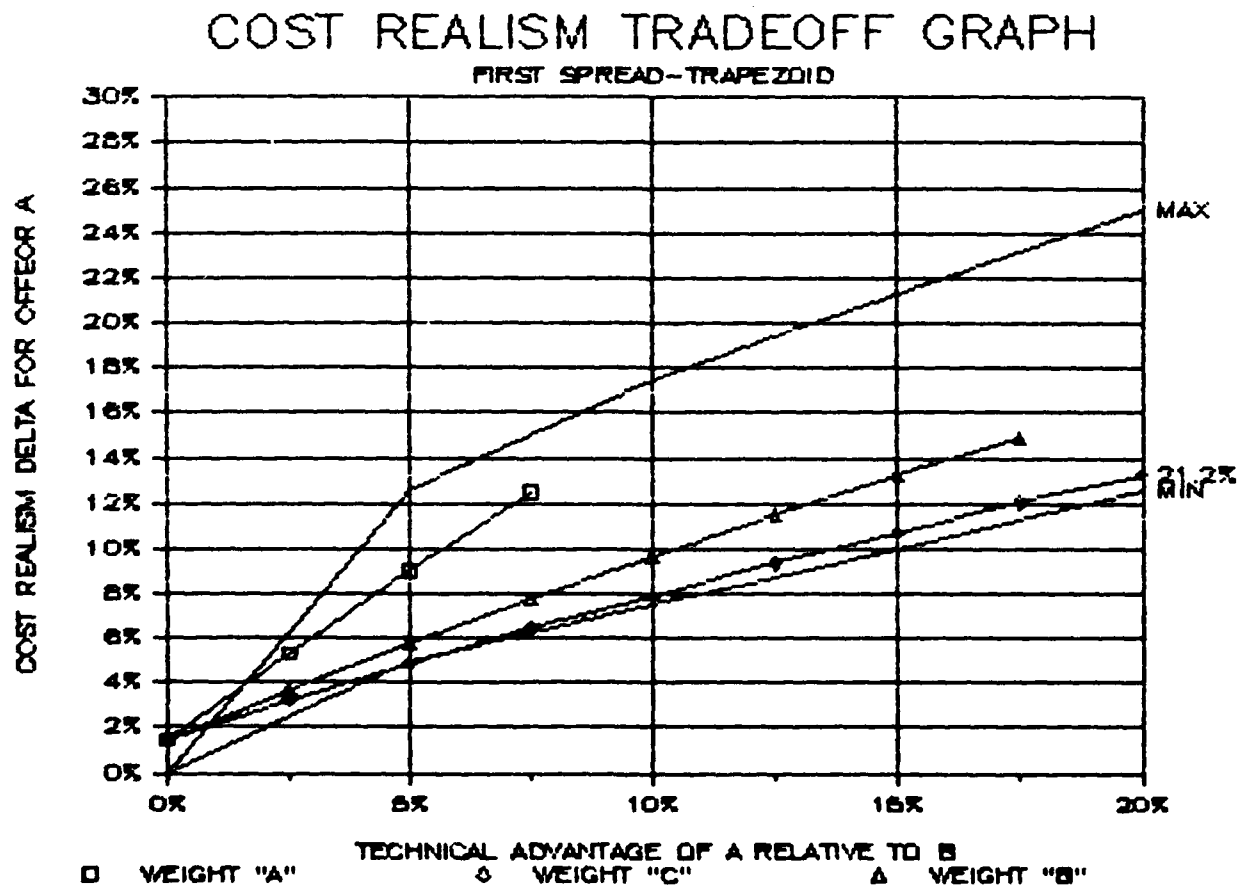


Figure 30.

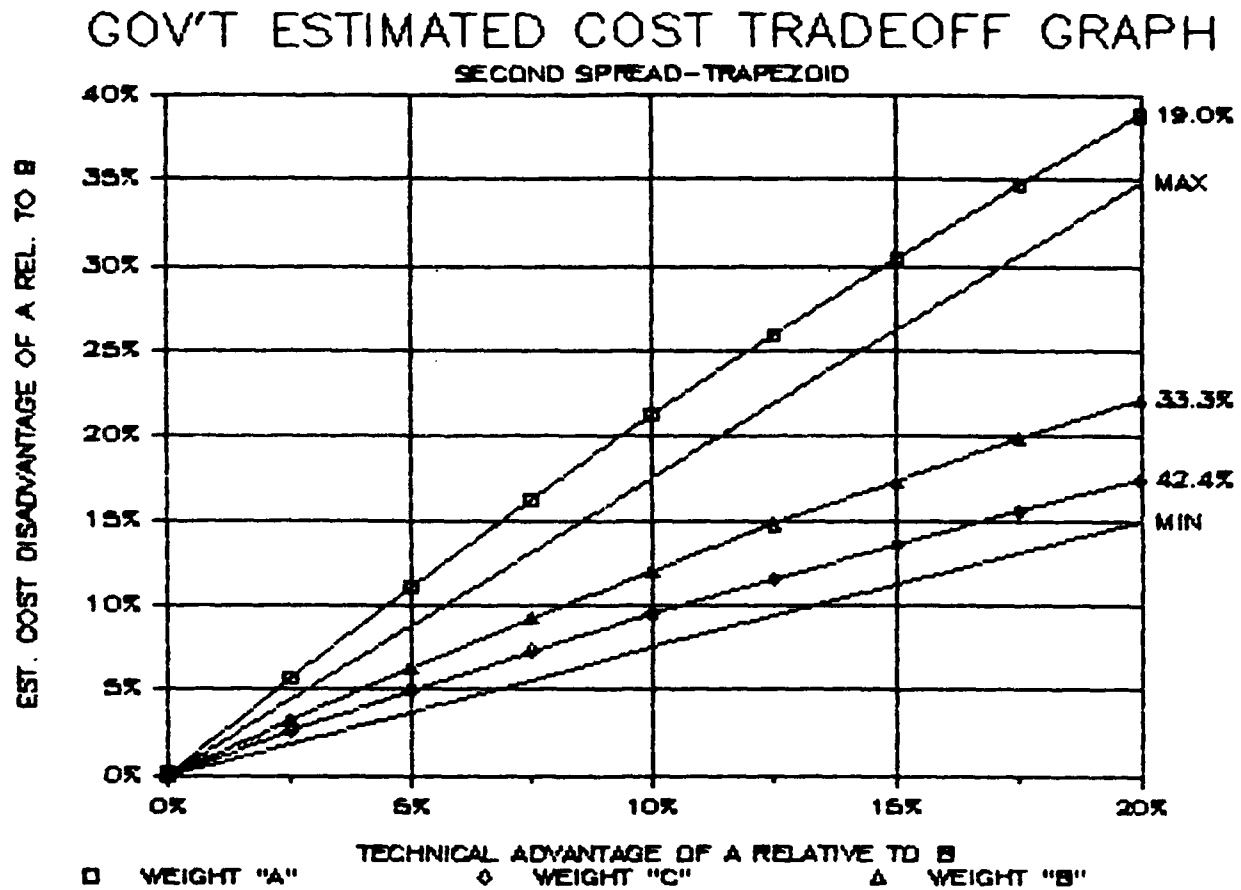


Figure 31.

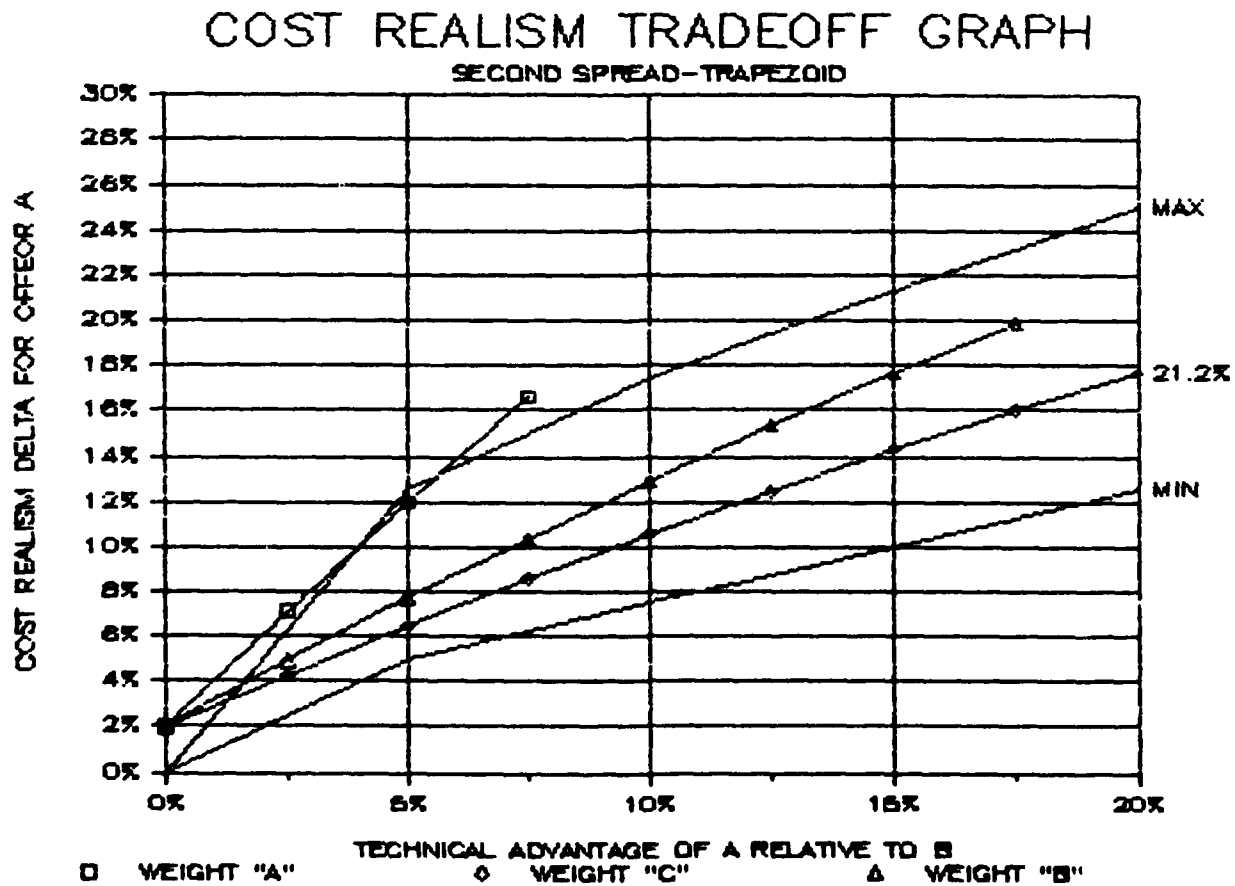


Figure 32.

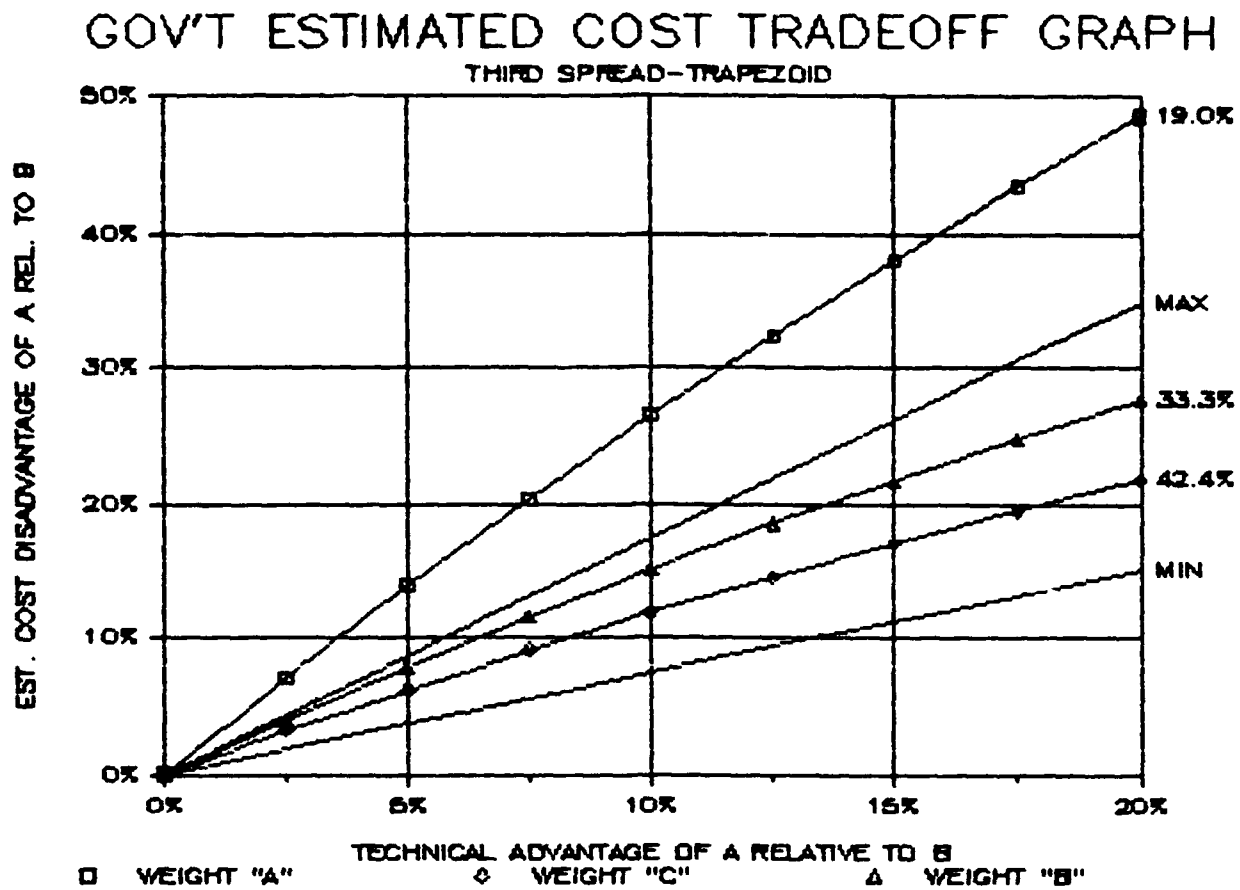


Figure 33.

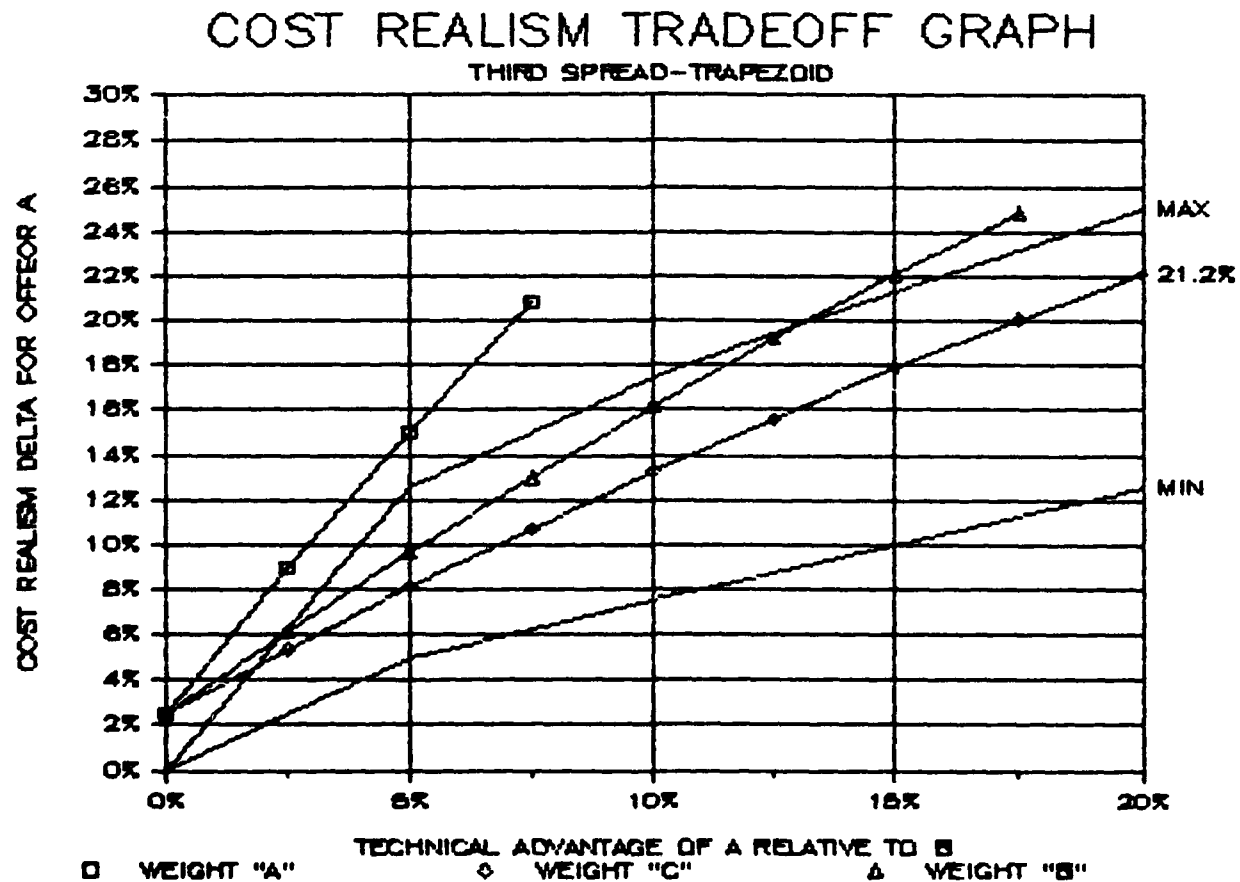


Figure 34.

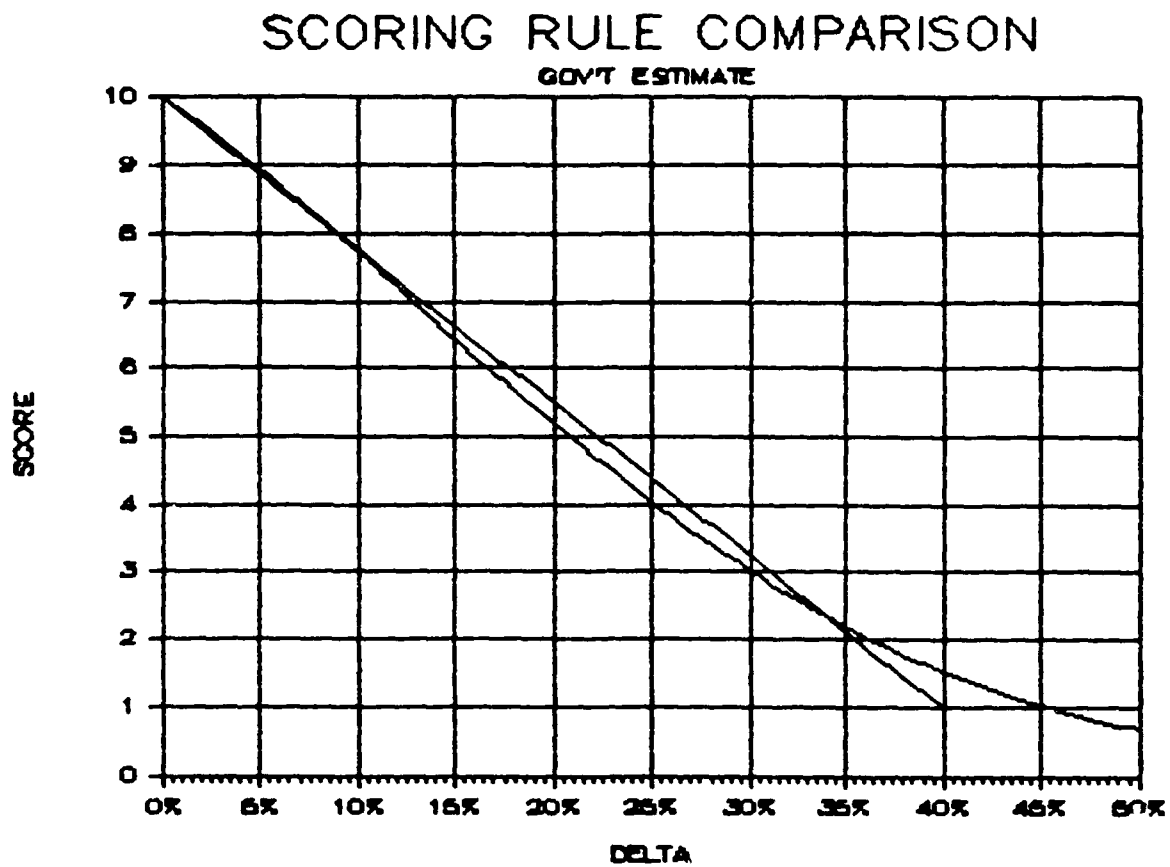


Figure 35.

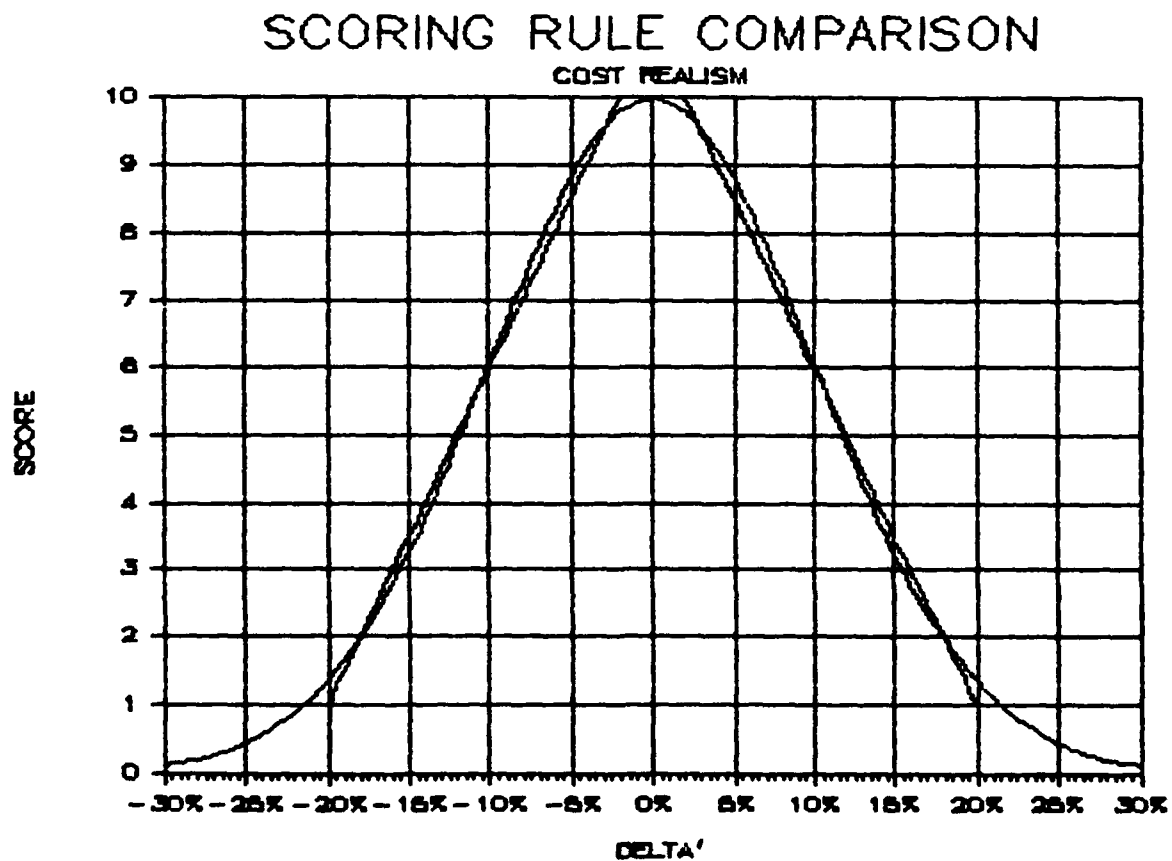


Table 7.

COST EVALUATION SCORING MODEL--NORMAL CURVE SHAPE

[SCNORM]

ENTER: SPREADS AS DECIMALS

----- WEIGHTS AS WHOLE NUMBERS -OR- ENTER WEIGHT RATIOS AS DECIMALS

SPREAD:

GOV'T EST COST
COST REALISM40.0%
20.0%

WEIGHT:

TECHNICAL (T)
GOV'T EST COST (E)
COST REALISM (R)
OTHER
TOTAL60.0
20.0
10.0
10.0
100.0AFTER ENTERING OR CHANGING DATA,
PRESS "F9" TO RECALCULATE

WEIGHT RATIO:

E/T
R/T
E/(E+R)
R/(E+R)33.3%
16.7%
66.7%
33.3%

OFFEROR	OFFER (C)	GOV'T EST (G)	(G-G*)/G* (DELTA)	(C-G)/G (DELTA')	GOV'T EST	REALISM
A	47.0	48.0	0.0%	-2.1%	10.0	9.8
B	47.0	54.0	12.5%	-13.0%	7.1	4.3
C	53.0	50.0	4.2%	6.0%	9.1	8.4
D	60.0	65.0	35.4%	-7.7%	2.1	7.4
E	89.0	70.0	45.8%	27.1%	1.0	0.3

OFFEROR	GOV'T EST	REALISM	SCORES TOTAL	% OF MAX	TECH ADV LOW	TRADEOFF HIGH
A	20.0	9.8	29.8	99%	0%	0%
B	14.2	4.3	18.5	62%	23%	27%
C	18.3	8.4	26.6	89%	6%	8%
D	4.3	7.4	11.7	39%	43%	43%
E	1.9	0.3	2.2	7%	85%	85%

OFFEROR	LOW	HIGH	LOW	HIGH
A	0.0%	2.0%	-0.1%	-4.1%
B	10.5%	14.5%	-11.0%	-15.0%
C	2.2%	6.2%	4.0%	8.0%
D	33.4%	37.4%	-5.7%	-9.7%
E	43.8%	47.8%	25.1%	29.1%

OFFEROR	LOW	HIGH	LOW	HIGH	LOW	HIGH
A	9.6	10.0	9.2	10.0	28.4	30.0
B	6.6	7.6	3.3	5.5	16.4	20.7
C	8.7	9.6	7.3	9.2	24.6	28.4
D	1.9	2.4	6.3	8.5	10.0	13.4
E	0.8	1.1	0.1	0.4	1.8	2.7

Table 7 (con't)

QUICK ENTRIES:

TO LOAD COMPLETE EXAMPLE, PRESS "ALT" KEY AND "X" SIMULTANEOUSLY
TO RETURN TO BLANK ENTRY FORM, PRESS "ALT" KEY AND "Y" SIMULTANEOUSLY

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY
----- (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
(TO RETURN TO THE WORKSHEET, PRESS "Q")

	GOV'T EST	REALISM	WEIGHTED
SCORE	A	B	C
RANGE	D	E	F

PRINT TABLE: PRESS "ALT" KEY AND "P" SIMULTANEOUSLY

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "B", AND
TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
(I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
NAME FOR EACH GRAPH--FOR EXAMPLE, A1, B1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

SENSITIVITY ANALYSIS: GO TO NEXT PART

Figure 36.

ESTIMATED COST SCORE

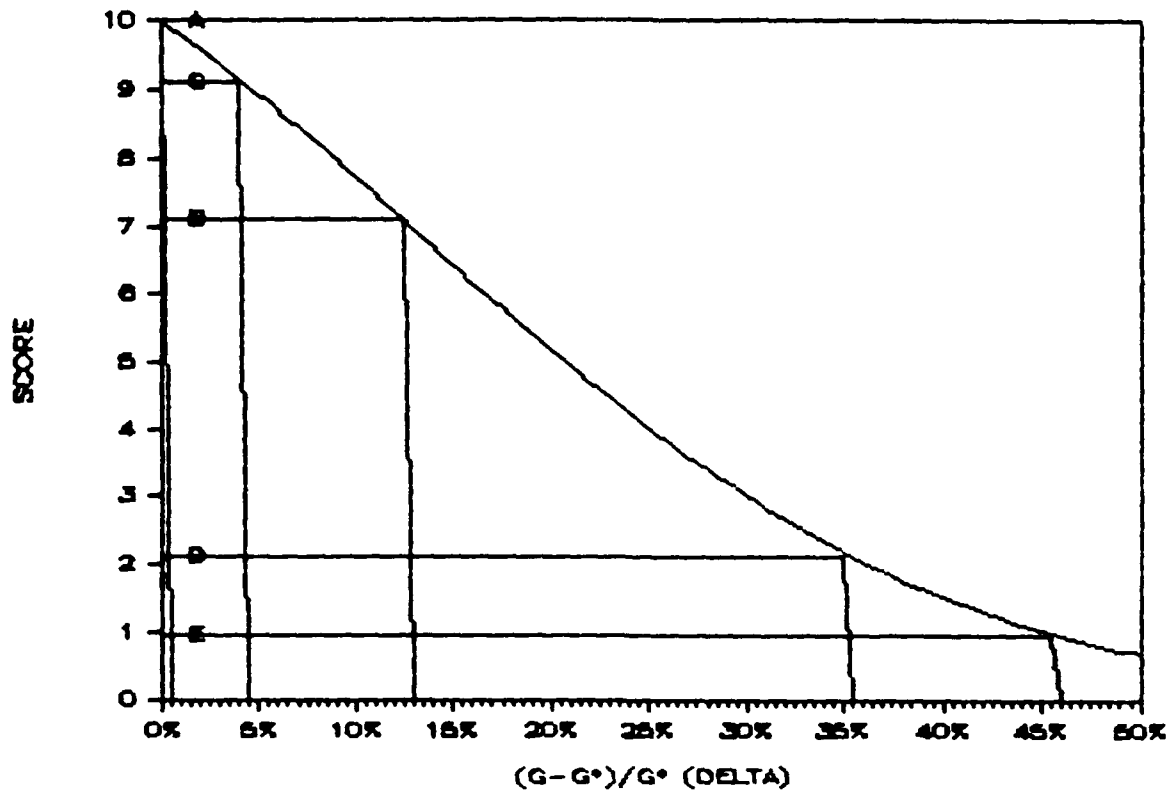


Figure 37.

COST REALISM SCORE

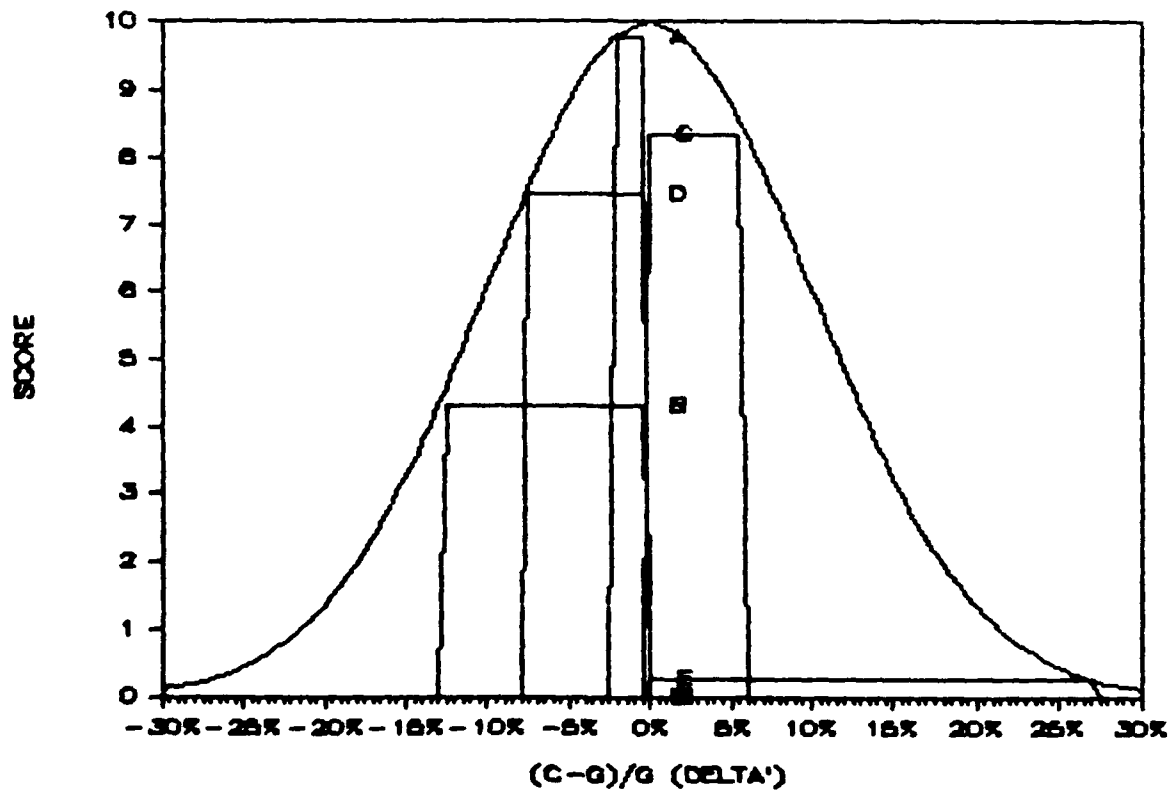


Figure 38.

TRAPEZOID AND NORMAL SCORES COMPARED

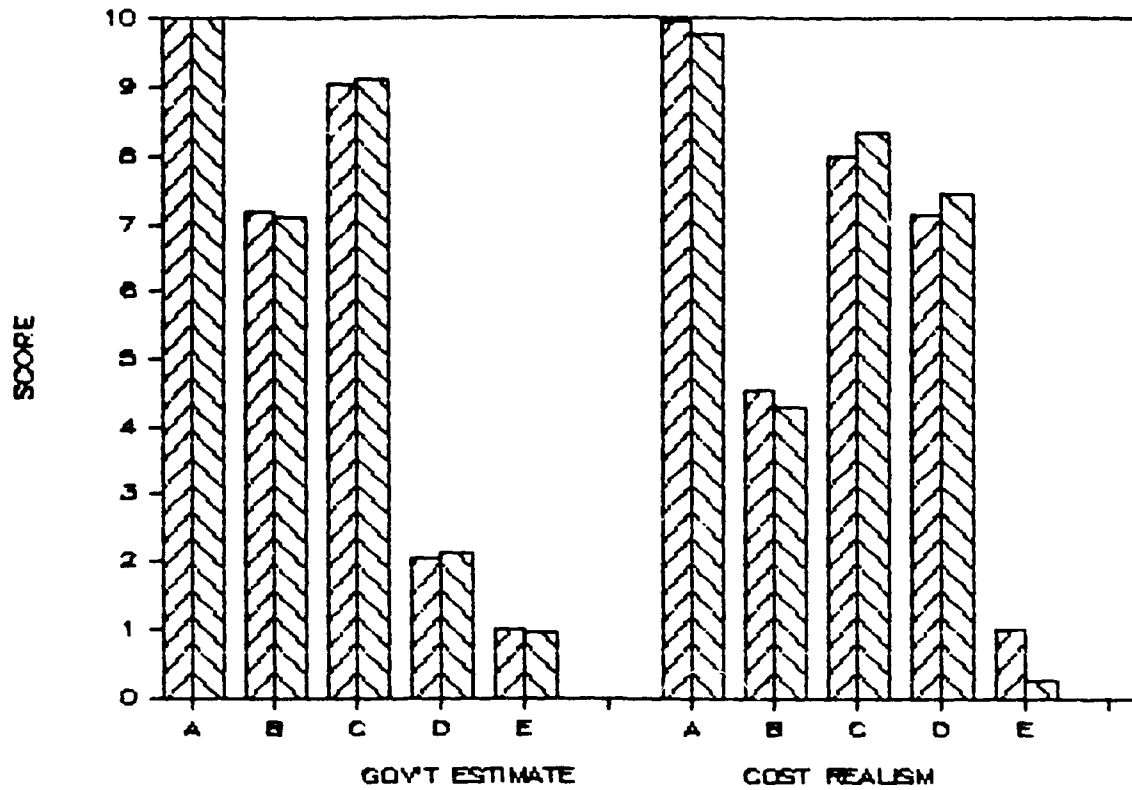


Figure 39.

TRAPEZOID AND NORMAL SCORES COMPARED

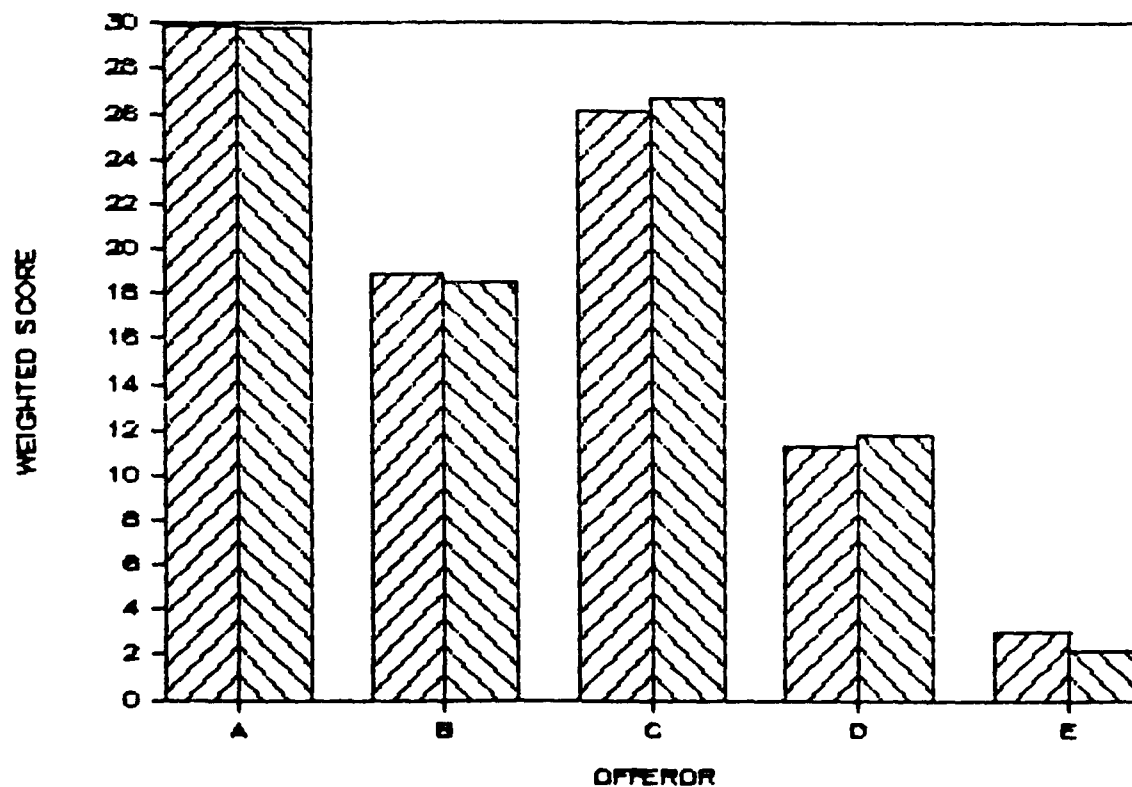


Table 8.

COST EVALUATION TRADEOFF MODEL--NORMAL CURVE SHAPE

[TRDNORM]

ENTER: SPREADS AND ENVELOPES AS DECIMALS

WEIGHTS AS WHOLE NUMBERS -OR- ENTER WEIGHT RATIOS AS DECIMALS
APPROXIMATE COST IN MILLIONS OF DOLLARS

SPREAD:	1ST	2ND	3RD	
GOV'T EST COST	30.0%	40.0%	50.0%]
COST REALISM	15.0%	20.0%	25.0%]

WEIGHT:	A	B	C	
TECHNICAL (T)	60.0	60.0	60.0]
GOV'T EST (E)	15.0	20.0	22.5]
COST REALISM (R)	15.0	10.0	7.5]
OTHER	10.0	10.0	10.0]
TOTAL	100.0	100.0	100.0]

WEIGHT RATIO:	A	B	C	
E/T	25.0%	33.3%	37.5%]
R/T	25.0%	16.7%	12.5%]
E/(E+R)	50.0%	66.7%	75.0%]
R/(E+R)	50.0%	33.3%	25.0%]

APPROXIMATE COST: \$50 MILLION (OPTIONAL)]

ENVELOPES: TECHNICAL ADVANTAGE	COST WILLING TO ACCEPT		UNREALISM WILLING TO ACCEPT	
	MIN	MAX	MIN	MAX
5.0%	3.8%	8.8%	5.0%	12.5%
10.0%	7.5%	17.5%	7.5%	17.5%
20.0%	15.0%	35.0%	12.5%	25.0%
5.0%	\$1.9	\$4.4	\$2.5	\$6.3
10.0%	\$3.8	\$8.8	\$3.8	\$8.8
20.0%	\$7.5	\$17.5	\$6.3	\$12.5

AFTER ENTERING OR CHANGING DATA, PRESS "F9" TO RECALCULATE

QUICK ENTRIES:

 TO LOAD ILLUSTRATIVE ENVELOPE, PRESS "ALT" KEY AND "V" SIMULTANEOUSLY
 TO LOAD COMPLETE EXAMPLE, PRESS "ALT" KEY AND "X" SIMULTANEOUSLY
 TO RETURN TO BLANK ENTRY FORM, PRESS "ALT" KEY AND "Y" SIMULTANEOUSLY

INVOKE GRAPHS: PRESS "ALT" KEY AND INDICATED LETTER SIMULTANEOUSLY

 (IF THERE IS A GRAPH ON THE SCREEN, FIRST PRESS ANY KEY)
 (TO RETURN TO THE WORKSHEET, PRESS "Q")

	1ST	2ND	3RD	SPREAD	BAND
	SPREAD	SPREAD	SPREAD	DIFFERENCE	
GOV'T EST COST	A	D	G	J	M
COST REALISM	B	E	H	K	N
GOV'T EST/REALISM	C	F	I	L	

NOTE: SPREAD DIFFERENCE FOR WT "B". BAND FOR 2ND SPREAD & WT "B"

Table 8 (con't)

PRINT TABLE: PRESS "ALT" KEY AND "P" SIMULTANEOUSLY

PRINT GRAPHS: SAVE EACH GRAPH TO A "PRINT-GRAPH" FILE AS FOLLOWS:

INVOKE GRAPH AS ABOVE, PRESS ANY KEY, PRESS "S", AND
TYPE IN A "PRINT-GRAPH" NAME USING APPROPRIATE LETTER
FROM ABOVE TABLE

IF MORE THAN ONE GRAPH IS TO BE SAVED OF THE SAME TYPE
(I.E., DIFFERENT ENTRIES IN THE TABLE), USE A DIFFERENT
NAME FOR EACH GRAPH--FOR EXAMPLE, A1, B1, ETC.

THEN, USE THE LOTUS "PRINT-GRAPH" DISK

Figure 40.

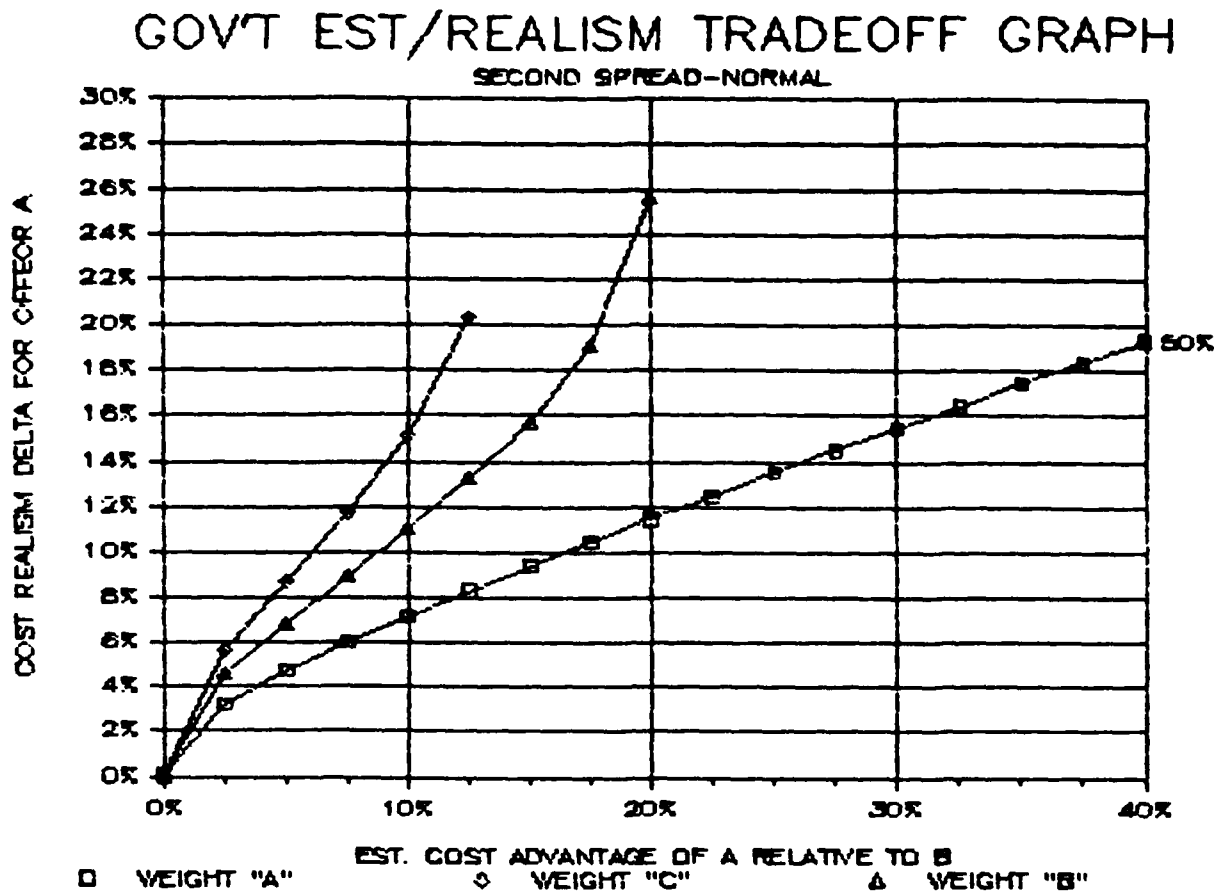


Figure 41.

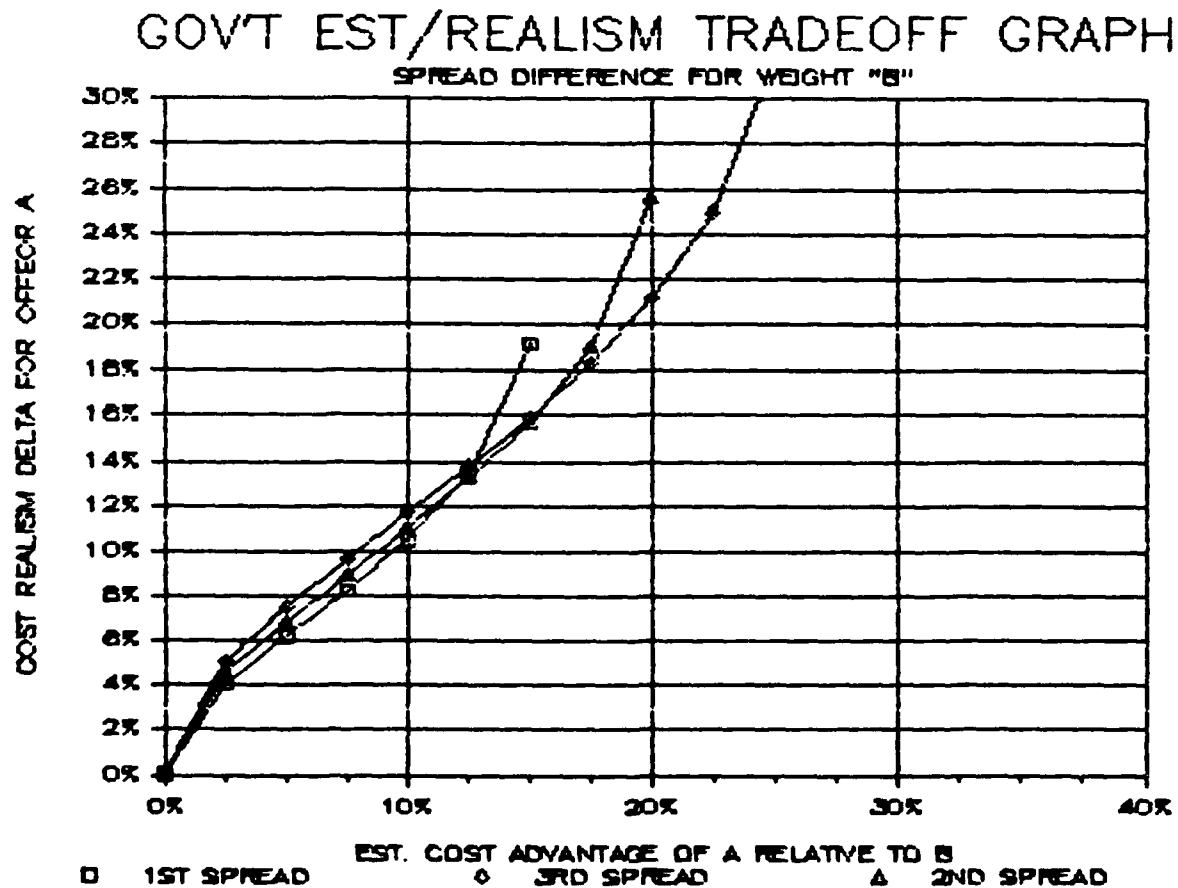


Figure 42.

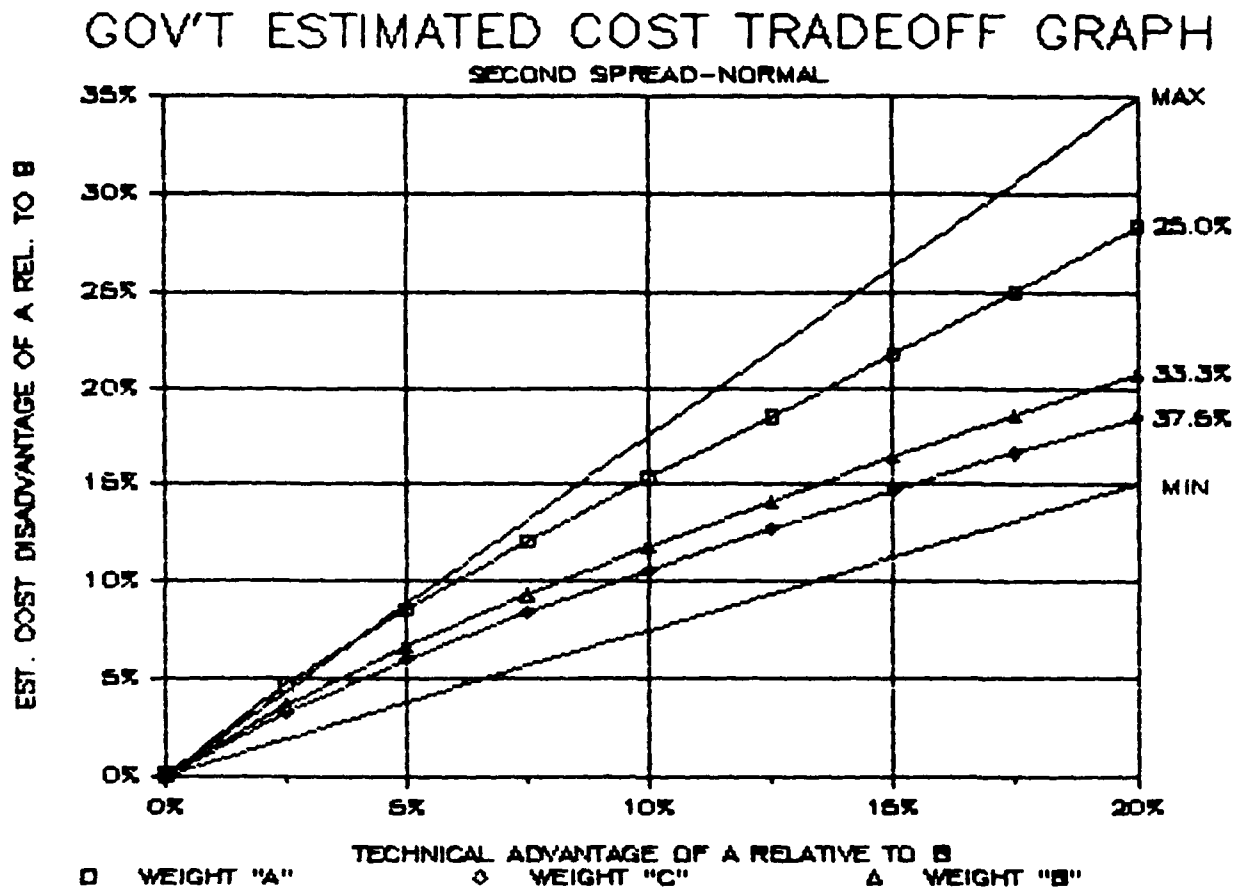


Figure 43.

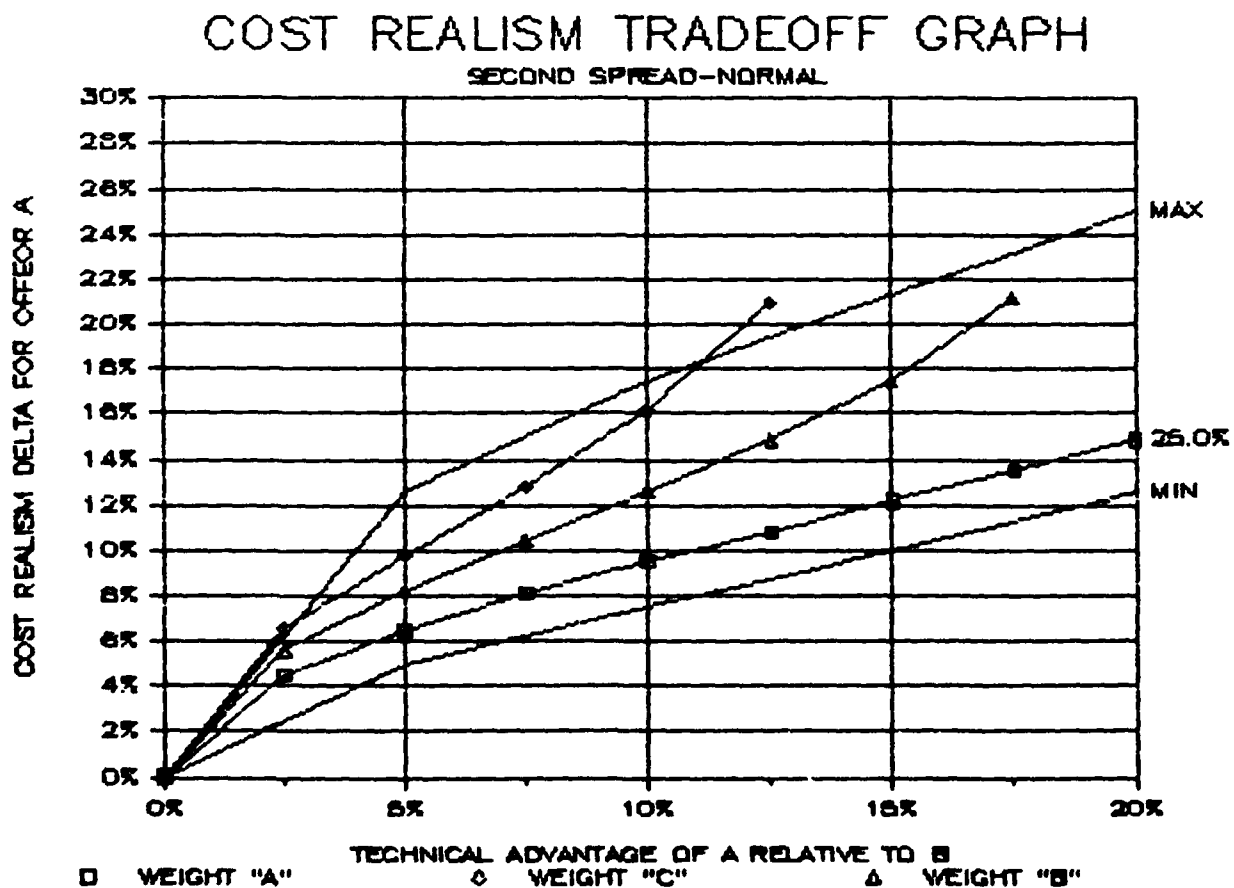


Table 9
SCTRAP Model Listing

Spread and Minimum Score Inputs

Gov't Est Base	C7: (P1) U 0
Gov't Est Top	D7: (P1) U 0
Gov't Est Min Score	E7: (F0) U 0
Cost Realism Base	C8: (P1) U 0
Cost Realism Top	D8: (P1) U 0
Cost Realism Min Score	E8: (F0) U 0

Weight Inputs

Technical	C11: (F1) U (C15-C14)/(1+C18+C19)
Gov't Est Cost	C12: (F1) U +C11*C18
Cost Realism	C13: (F1) U +C11*C19
Other	C14: (F1) U 0
Total	C15: (F1) U 100

Weight Ratios

E/T	C18: (P1) U +C12/C11
R/T	C19: (P1) U +C13/C11
E/(E+R)	C20: (P1) U +C18/(C18+C19)
R/(E+R)	C21: (P1) U +C19/(C18+C19)

C, G, Deltas & Scores for Offeror A

Offeror (C) Input	B26: (,1) U 0
Gov't Est (G) Input	C26: (,1) U 0
Delta	D26: (P1) @IF(C26=0,@NA,(C26-\$P\$26)/\$P\$26)
Delta'	E26: (P1) @IF(C26=0,@NA,(B26-C26)/C26)
Gov't Est Score	F26: (F1) @IF(D26<\$D\$7,10,@IF(D26<\$C\$7,((10-\$E\$7)*(\$C\$7-D26)/(\$C\$7-\$D\$7))+\$E\$7,\$E\$7))
Cost Realism Score	G26: (F1) @IF(@ABS(E26)<\$D\$8,10,@IF(@ABS(E26)<\$C\$8,((10-\$E\$8)*(\$C\$8-@ABS(E26))/(\$C\$8-\$D\$8))+\$E\$8,\$E\$8))

Weighted Scores for Offeror A

Gov't Est	B35: (F1) +F26*\$C\$12/10
Cost Realism	C35: (F1) +G26*\$C\$13/10
Total	D35: (F1) +B35+C35
Percent of Max	E35: (P0) +D35/(C\$12+C\$13)
Tech Adv Tradeoff--High	F35: (P0) (R\$26-D35)/(C\$11-R\$26+D35)
Tech Adv Tradeoff--Low	G35: (P0) @IF(R35>F35,R35,F35)

Table 9 (continued)

Delta Range (+2%) for Offeror A

Gov't Est Low	B45: (P1) @IF((D26-0.02)<0,0,D26-0.02)
Gov't Est High	C45: (P1) +D26+0.02
Cost Realism Low	D45: (P1) @IF(E26<0,E26+0.02,E26-0.02)
Cost Realism High	E45: (P1) @IF(E26<0,E26-0.02,E26+0.02)

Score Range for Offeror A

Gov't Est Low	B55: (F1) @IF(C45<\$D\$7,10,@IF(C45<\$C\$7,((10-\$E\$7)*(\$C\$7-C45)/(\$C\$7-\$D\$7))+E\$7,E\$7))
Gov't Est High	C55: (F1) @IF(B45<\$D\$7,10,@IF(B45<\$C\$7,((10-\$E\$7)*(\$C\$7-B45)/(\$C\$7-\$D\$7))+E\$7,E\$7))
Cost Realism Low	D55: (F1) @IF(@ABS(E45)<\$D\$8,10,@IF(@ABS(E45)<\$C\$8,((10-\$E\$8)*(\$C\$8-@ABS(E45))/(\$C\$8-\$D\$8))+E\$8,E\$8))
Cost Realism High	E55: (F1) @IF(@ABS(D45)<\$D\$8,10,@IF(@ABS(D45)<\$C\$8,((10-\$E\$8)*(\$C\$8-@ABS(D45))/(\$C\$8-\$D\$8))+E\$8,E\$8))
Weighted Low	F55: (F1) +B55*\$C\$12/10+D55*\$C\$13/10
Weighted High	G55: (F1) +C55*\$C\$12/10+E55*\$C\$13/10

Scoring Plotting Points

Gov't Est Score	B192: (F1) @IF(A192<\$D\$7,10,@IF(A192<\$C\$7,((10-\$E\$7)*(\$C\$7-A192)/(\$C\$7-\$D\$7))+E\$7,E\$7))
Plotting Point for A	C192: (F1) @IF(\$D\$26>=\$A192,\$F\$26,0)
Cost Realism Score	B299: (F1) @IF(@ABS(A299)<\$D\$8,10,@IF(@ABS(A299)<\$C\$8,((10-\$E\$8)*(\$C\$8-@ABS(A299))/(\$C\$8-\$D\$8))+E\$8,E\$8))
Plotting Point for A	C299: (F1) @IF(\$E\$26<=\$A299#AND#\$E\$26<0,\$G\$26,0)

Table 10
TRDTRAP Model Listing

Spread and Minimum Score Inputs

1st Gov't Est Base	B9: (P1) U 0
2nd Gov't Est Base	C9: (P1) U 0
3rd Gov't Est Base	D9: (P1) U 0
1st Gov't Est Top	E9: (P1) U 0
2nd Gov't Est Top	F9: (P1) U 0
3rd Gov't Est Top	G9: (P1) U 0
Gov't Est Min Score	H9: (F0) U 1
1st Cost Realism Base	B10: (P1) U 0
2nd Cost Realism Base	C10: (P1) U 0
3rd Cost Realism Base	D10: (P1) U 0
1st Cost Realism Top	E10: (P1) U 0
2nd Cost Realism Top	F10: (P1) U 0
3rd Cost Realism Top	G10: (P1) U 0
Cost Realism Min Score	H10: (F0) U 1

Weight Inputs for Weight A

Technical	C13: (F1) U $(C17 - C16) / (1 + C20 + C21)$
Gov't Est	C14: (F1) U $+C13 * C20$
Cost Realism	C15: (F1) U $+C13 * C21$
Other	C16: (F1) U 0
Total	C17: (F1) 100

Weight Ratios for Weight A

E/T	C20: (P1) U $+C14 / C13$
R/T	C21: (P1) U $+C15 / C13$
E(E+R)	C22: (P1) $+C20 / (C20 + C21)$
R(E+R)	C23: (P1) $+C21 / (C20 + C21)$

Approximate Cost Input C25: (C0) U 0

Indifference Envelope Inputs

Gov't Est Min %	C31: (P1) U $+C35 / \$C\25
Gov't Est Max %	D31: (P1) U $+D35 / \$C\25
Cost Realism Min %	E31: (P1) U $+E35 / \$C\25
Cost Realism Max %	F31: (P1) U $+F35 / \$C\25
Gov't Est Min \$	C35: (C1) U $+\$C\$25 * C31$
Gov't Est Max \$	D35: (C1) U $+\$C\$25 * D31$
Cost Realism Min \$	E35: (C1) U $+\$C\$25 * E31$
Cost Realism Max \$	F35: (C1) U $+\$C\$25 * F31$

Table 10 (continued)

Tradeoff Plotting Points for Weight A and First Spread Follow:

Gov't Est for Each Technical Advantage

Unadj Cost Disadv C85: (P1) $((\$B\$9 - \$E\$9) / (1 - 0.1 * \$H\$9)) * \$A85 /$
 $(\$C\$20 * (1 + \$A85)) + \$E\$9$
 Adj Cost Disadv F85: (P1) @IF($\$A85 / (\$C\$20 * (1 + \$A85)) < (1 - 0.1$
 $* \$H\$9)$, +C85, @NA)

Cost Realism for Each Technical Advantage

Unadj Cost Realism C126: (P1) $((\$B\$10 - \$E\$10) / (1 - 0.1 * \$H\$10))$
 $* \$A126 / (\$C\$21 * (1 + \$A126)) + \$E\10
 Adj Cost Realism F126: (P1) @IF($\$A126 / (\$C\$21 * (1 + \$A126)) < (1 -$
 $0.1 * \$H\$10)$, +C126, @NA)

Gov't Est/Cost Realism for Each Gov't Est Cost Advantage

Unadj Cost Realism C167: (P1) $+\$B\$10 - (\$B\$10 - \$E\$10) * (1 - (\$C\$20 * (1 -$
 $0.1 * \$H\$9) / (\$C\$21 * (1 - 0.1 * \$H\$10))) * (1 - (\$B\$9 - \$B167) / (\$B\$9 - \$E\$9))$
 Adj Cost Realism F167: (P1) @IF($C167 \leq \$B\10 , C167, @NA)

Gov't Est Band for Each Technical Advantage

Unadj Intermed I96: (P1) $((\$A96 / (\$D\$20 * (1 + \$A96))) * (\$C\9
 $- \$F\$9) / (1 - 0.1 * \$H\$9)) / 1.05$
 Unadj Lower J96: (P1) $+\$C\$9 - ((1 - 0.1 * \$H\$9 - 0.7 * \$A96 /$
 $(\$D\$20)) * (\$C\$9 - \$F\$9) / (1 - 0.1 * \$H\$9))$
 Intermed K96: (P1) @IF($\$A96 / (\$D\$20 * (1 - \$A96)) < (1 -$
 $0.1 * \$H\$9)$, +I96, @NA)
 Lower Band L96: (P1) @IF($\$A96 / (\$D\$20 * (1 - \$A96)) < (1 -$
 $0.1 * \$H\$9)$, +J96, @NA)

Cost Realism Band for Each Technical Advantage

Unadj Delta' I137: (P1) $((\$A137 / (\$D\$21 * (1 + \$A137))) * (\$C\$10 -$
 $\$F\$10) / (1 - 0.1 * \$H\$10)) / 1.05$
 Unadj Tech Adv J137: (P1) $+\$C\$10 - ((1 - 0.1 * \$H\$10 - 0.7 * \$A137 /$
 $(\$D\$21)) * (\$C\$10 - \$F\$10) / (1 - 0.1 * \$H\$10))$
 Adj Delta' K137: (P1) @IF($\$A137 / (\$D\$21 * (1 + \$A137)) < (1 -$
 $0.1 * \$H\$10)$, +I137, @NA)
 Adj Tech Adv L137: (P1) @IF($\$A137 / (\$D\$21 * (1 + \$A137)) < (1 -$
 $0.1 * \$H\$10)$, +J137, @NA)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This Cost Realism Handbook provides the Defense acquisition community with a methodology for evaluating contractor cost proposals, with particular emphasis on assuring more realistic cost proposals. This should be of particular interest to source selection cost evaluation teams, as well as to contracting		

officers and program managers. The methodology is applicable mainly to competitive, cost reimbursable contracts. The Handbook explains the various steps of the methodology in detail, provides an illustrative example, and describes computer models which may be useful in establishing scoring rules and evaluation factor weights.

The methodology includes four interrelated steps:

- (1) Evaluation Factors: Determination of cost evaluation factors;
- (2) Solicitation: Preparation of instructions to be included in the solicitation concerning the cost evaluation factors;
- (3) Government Estimate: Preparation of a Government estimated cost for each contractor; and
- (4) Evaluation: Rating or scoring each contractor for Government estimated cost and cost realism.

The methodology involves the best techniques and procedures currently being used in source selection cost evaluation. In addition this Handbook introduces several improvements to the current techniques, especially in the area of numerical scoring.

It is believed that application of this methodology will encourage contractors to make more realistic offers since they will be on notice, through the solicitation, that cost realism will be examined and could be a deciding factor in the award. The contractors will know that the evaluation procedures will reduce the likelihood of awards to low offers on cost reimbursable contracts unless realistically low, if cost is the deciding factor.